INSTRUCTION MANUAL

MODEL TMR-18B
TELEMETRY RECEIVER

23 February 1966

Defense Electronics, Inc.
Rockville, Maryland

TABLE OF CONTENTS

Section		Title	Page
I		GENERAL DESCRIPTION	
	1.1	Introduction	1-1
	1.2	Electrical and Physical Characteristics	1-1
II		PRINCIPLES OF OPERATION	
	2.1	General	2-1
	2.2	Circuit Analysis	2-1
	2.2.1	RF Tuning Unit	2-1
	2.2.2	First IF Amplifier	2-2
	2.2.3	Second IF Amplifier	2-4
	2.2.4	FM Demodulator	2-4
	2.2.5	Deviation Meter Circuit	2-6
	2.2.6	Predetection Down-Converter	2-6
	2.2.7	AGC Amplifier	2-7
	2.2.8	Video Filters	2-9
	2.2.9	Dual Video Amplifier	2-9
	2.2.10	Audio Amplifier	2-9
	2.2.11	Power Supply Regulator	2-10
	2.2.12	Power Supply	2-10
III		OPERATION	
	3.1	Introduction	3-1
	3.2	Controls and Indicators	3-1
	3.2.1	Main Chassis	3-1
	3.2.1.1	Power	3-1
	3.2.1.2	Audio Volume	3-1
	3.2.1.3	Second LO Mode	3-1
	3.2.1.4	Second LO Vernier Tuning KC	3-1
	3.2.1.5	Video Filter Bandwidth	3-1
	3.2.1.6	Video Gain	3-2
	3.2.1.7	Output Meter Calibrate	3-2
	3.2.1.8	Output Meter	3-2
	3.2.1.9	Deviation Meter	3-2
	3.2.1.10	Tuning Meter	3-2
	3.2.1.11	Signal Level Meter	3-2
	3.2.2	RF Tuning Unit	3-3
	3.2.2.1	Tuning	3-3
	3.2.2.2	First LO Mode	3-3
	3.2.2.3	Frequency Dial	3-3
	3.2.3	Controls Accessible on the Rear Apron	3-3
	3.2.3.1	AGC Normal/Off	3-3
	3.2.3.2	AGC Record Adjust	3-3

TABLE OF CONTENTS (Cont)

Section		Title	Page
III	3.3	Normal Operation	3-3
	3.4	Internal Adjustments	3-4
IV	RANGE MAINTENANCE		
	4.1	Introduction	4-1
	4.2	Recommended Schedules	4-1
	4.2.1	Daily	4-2
	4.2.2	Weekly	4-2
	4.2.3	Monthly	4-2
	4.2.4	Quarterly	4-2
	4.2.5	Semiannual	4-3
	4.3	Assembly and Disassembly	4-3
	4.4	Periodic Operational Checks	4-4
	4.4.1	IF Gain Adjust and IF Output Check	4-4
	4.4.2	Noise Figure Check	4-4
	4.4.3	Signal Level Meter Calibration	4-5
	4.4.4	Video Output Levels	4-6
	4.4.5	Predetection Down-Converter Output Level	4-6
	4.4.6	2nd LO Vernier Tuning Range	4-7
	4.4.7	AGC Record Output Calibration	4-7
	4.4.8	Metering Performance	4-8
V	BASE MAINTENANCE		
	5.1	Major Overhaul	5-1
	5.2	Special Component Fabrication and Repair	5-1
	5.3	Performance Requirements	5-2
	5.4	Special Corrective Maintenance Requirements	5-2
	5.5	Recommended Test Equipment and Test Fixtures	5-2
	5.5.1	Initial Test Setup	5-3
	5.6	Alignment Procedures	5-4
	5.6.1	Power Supply Adjustments and Checks	5-4
	5.6.2	Dual Video Amplifier	5-4
	5.6.3	Predetection Down-Converter	5-6
	5.6.4	FM Demodulator	5-7
	5.6.5	Audio Amplifier	5-10
	5.6.6	Second IF Amplifier	5-11
	5.6.6.1	500 KC Bandpass Filter	5-11
	5.6.6.2	10 MC Amplifier	5-13
	5.6.7	First IF Amplifier	5-14
	5.6.8	AGC Amplifier	5-16
	5.6.9	Overall Receiver	5-17

TABLE OF CONTENTS (Cont)

Section		Title	Page
VI		INSTALLATION	
	6.1	Receipt and Unpacking	6-1
	6.2	Inspection	6-1
	6.3	Mounting	6-1
	6.4	Storage	6-2
	6.5	Special Mounting Requirements	6-2
VII		ELECTRICAL PARTS LIST	7-1
VIII		SCHEMATIC DIAGRAMS	8-1

LIST OF ILLUSTRATIONS

Figure	Title	Page
1-1	Model TMR-18B Telemetry Receiver	1-0
1-2	Model TMR-18B Telemetry Receiver, Block Diagram.	1-7
2-1	Voltage-Controlled Attenuator, Simplified Schematic Diagram	2-2
2-2	Vernier Control Circuitry, Simplified Schematic Diagram	2-3
2-3	AGC Circuitry, Simplified Block Diagram	2-7
3-1	Model TMR-18B Telemetry Receiver, Front Panel View	3-2
5-1	Model TMR-18B Telemetry Receiver, Top View with Cover Removed	5-20
5-2	Model TMR-18B Telemetry Receiver, Bottom View with Cover Removed	5-21
6-1	Model TMR-18B Receiver, Rear View	6-2
8-1	Model TMR-18B Telemetry Receiver, Schematic Diagram R34266	8-3
8-2	A2, First IF Amplifier, Schematic Diagram R34112	8-5
8-3	A3, Second IF Amplifier, Schematic Diagram R33826	8-6
8-4	A4, FM Demodulator, Schematic Diagram R33874	8-7
8-5	A5, Predetection Down Converter, Schematic Diagram D33819	8-8
8-6	A6, AGC Amplifier, Schematic Diagram D31902	8-9
8-7	A7, Dual Video Amplifier, Schematic Diagram D31901	8-10
8-8	A8, Audio Amplifier, Schematic Diagram D31848	8-11
8-9	A9, Power Supply Regulator, Schematic Diagram D31883	8-12

LIST OF TABLES

Number	Title	Page
1-1	Electrical and Physical Specifications	1-2
1-2	Transistor Complement	1-5
4-1	Cleaning and Painting Materials	4-3
6-1	Rear Apron Connectors	6-3

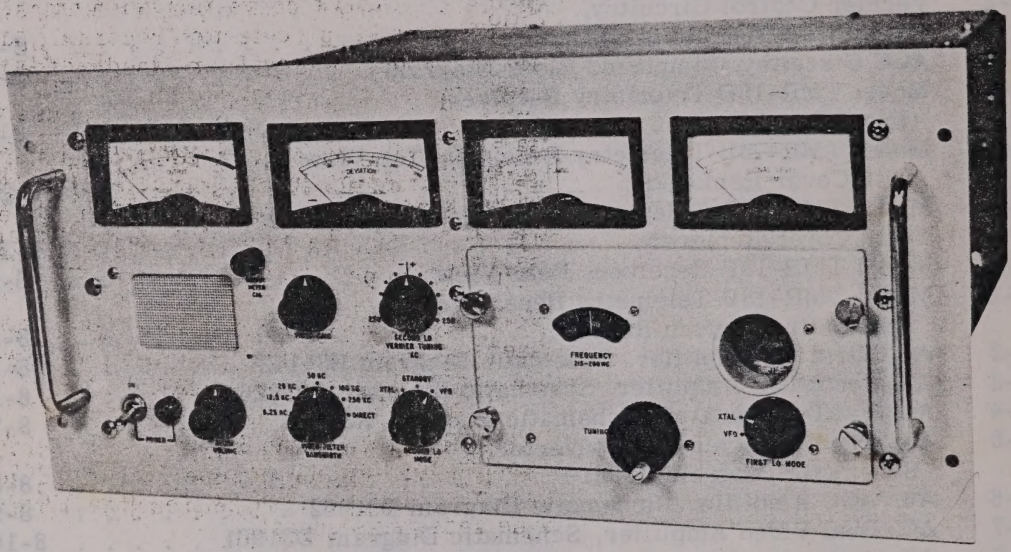


Figure 1-1. Model TMR-18B Telemetry Receiver

SECTION I
GENERAL DESCRIPTION

1.1 INTRODUCTION

The Model TMR-18B Telemetry Receiver, figure 1-1, is a double-superheterodyne receiver designed to meet the highest performance needs of specialized telemetry applications throughout the frequency ranges of 215 mc to 260 mc, and 2200 mc to 2300 mc.

The TMR-18B features an integral predetection down-converter which translates the 10 mc i-f to 450 kc video carrier frequency for predetection recording purposes. Linear or non-linear predetection recording output furnished by the receiver provides versatility for predetection recording applications.

The TMR-18B is a complete, self-contained unit designed for mounting in a standard 19-inch equipment rack. Two plug-in rf tuning units, available for use with the receiver, cover the frequency spectrum of the receiver's operation. The rf tuning unit plugs into the receiver through an opening in the receiver's front panel and is held in place with knurled thumbscrews.

Solid-state circuitry is used in the TMR-18B to provide quality performance and maximum reliability. Power transformers are hermetically sealed and all components are conservatively rated for maximum life and reliabiability.

Human engineering principles in the grouping of front panel controls and indicators have been exercised with a goal toward achieving maximum operator efficiency. Only the essential controls and indicators are mounted on the front panel presenting less complexity to an operator for the receiver's operation.

1.2 ELECTRICAL AND PHYSICAL CHARACTERISTICS

The electrical and physical specifications for the TMR-18B are listed in table 1-1 The TMR-18B consists of a main chassis, four sub-chassis mounted, and four printed-circuit card subassemblies. The receiver employs a 30-mc first i-f amplifier, two switch selectable 40-mc second local oscillators (vfo and crystal), a 10-mc second i-f amplifier, automatic gain control circuitry, a Foster-Seely demodulator, six switch selectable video filters, a video and an audio amplifier, a predetection down-converter, and metering circuitry for the reception and demodulation of telemetry signals present in the passband of the tuning units. The receiver provides two video outputs, a predetection video carrier output, deviation voltage output, 10-mc i-f output, first local oscillator output, afc output, signal strength (agc) output, metering, and audio outputs for monitoring and recording purposes. A functional block diagram showing the functional interconnection of the receiver's subassemblies is presented in figure 1-2.

The reference designation, transistor type, and function of each transistor employed in each subassembly are listed in table 1-2.

The rf tuning unit is a self-contained plug-in module interconnected to the receiver through a coaxial cable and a sliding type connector. An opening in the receiver's front panel facilitates the installation of the rf tuning unit into the receiver. The output frequency of the tuning unit, when properly tuned to a signal within its bandpass, is 30 mc; this 30-mc signal is applied to the first i-f amplifier subassembly of the receiver.

The rf tuning units designed for use with the receiver are the Model RTH-B18B, RF Tuning Unit, having a frequency range of 215 mc through 260 mc, and the Model RTH-F18B RF Tuning Unit, having a frequency range of 2200 mc through 2300 mc. For the electrical and physical specifications of each rf tuning unit, refer to the individual instruction manual for that specific unit.

Table 1-1. Electrical and Physical Specifications

Type Receiver	double superheterodyne: 30 mc first i-f, 10 mc second i-f.
Input Impedance	operates from 50 ohm source.
Tuning Range	215 mc to 260 mc and 2200 mc to 2300 mc, determined by plug-in tuning unit.
Tuning Units	(1) 215 mc to 260 mc, RTH-B18B (2) 2200 mc to 2300 mc, RTH-F18B
Noise Figure	215 mc to 260 mc - 8 db, maximum 2200 mc to 2300 mc - 11 db, maximum
Second Local Oscillator	VFO; tuning range ±250 kc, stability ±0.005%/C; XTAL; stability ±0.001%/C.
Second IF Amplifier Characteristics:	
Bandwidth	3 db bandwidth of 500 kc ±10%.
Selectivity	60 db/6 db bandwidth ratio 2.5:1, maximum.
Symmetry	10% maximum defined as $\%\ \text{symmetry} = \frac{F_1 - F_2}{F_1 + F_2} \times 100$ where F_1 = measured from 10 mc to upper 3 db point.

continued

Table 1-1, cont'd

Symmetry, cont'd	where F_2 = measured from 10 mc to lower 3 db point.
Bandpass Ripple	±0.5 db, maximum.
FM Demodulator Characteristics:	
Linearity	maximum departure from best straight line of dc output vs center frequency deviation does not exceed 1% of peak output for ±250 kc deviation.
FM Frequency Response	approximately 200 kc
AM Rejection	50% a-m, referenced to 100 kc deviation. 400 cps to 10 kc - greater than 50 db; 10 kc to 30 kc - greater than 35 db; 30 kc to 80 kc - greater than 25 db.
Dual Video Amplifier Characteristics:	
Frequency Response	within -3 db to +1 db from 1 cps to 1.0 mc referenced to 10 kc.
Video Bandwidth	maximally linear phase response low-pass filters with -3 db response of 6.25 kc, 12.5 kc, 25 kc, 50 kc, 100 kc, and 200 kc selectable from the front panel (asymptotic slope of 36 db per octave); a direct position facilitates alignment of the dual video amplifier.
Rated Output	8 volts peak-to-peak for 125 kc deviation.
Load Impedance	75 ohms; receiver performance not degraded with load impedances up to 10 kilohms shunted by 5000 uuf.
Output Isolation	20 db minimum. A short circuit on either video output will affect the output level of the other output by less than 10%.
Automatic Gain Control Characteristics:	
AGC Time Constant	fixed at less than 0.001 seconds.
AGC Control	input to the limiters will vary less than 3 db for input signal range from -100 dbm to 0 dbm.
AGC Disable	switch provides for either agc normal operation or fixed gain operation.

continued

Table 1-1, cont'd

Automatic Gain Control Characteristics, cont'd	
Signal Strength Record Output	output swing for full dynamic range is from -5 to +5 volts. Rear apron control provides adjustment to -5 volts with no signal input to receiver.
Predetection Down-Converter Characteristics:	
Video Carrier Frequency	450 kc CF - 600 kc BW, minimum.
Rated Output	6 volts peak-to-peak.
Load Impedance	93 ohms.
Predetection Availability	internal coaxial cable connection provides selection of 10-mc input before limiting or after limiting.
External Outputs	(1) first local oscillator output (2) ~~display unit output~~ 30 MHz (3) video output A (4) video output B (5) agc output (6) predetection output (7) deviation output (8) ~~i-f output~~ 10 MHz (9) afc output
Metering	(1) Tuning Meter - provides indication of proper receiver tuning. Full-scale sensitivity is approximately 150 kc. (2) Signal Level Meter - indicates the level of the rf signal applied to the receiver. The meter is calibrated in two scales due to the difference between the agc characteristics of the uhf and vhf tuning units. Each scale is calibrated in dbm from -120 dbm to 0 dbm with ±6 dbm accuracy. (3) Deviation Meter - indicates deviation present on the received signal in kilocycles. (4) Output Meter - indicates output level from video output A. Zero db reference is adjustable by a front panel control.

continued

Table 1-1, cont'd

Aural Monitoring.	built-in audio amplifier, gain control, and front panel speaker.
Power Requirement	115 (±10) vac, 60 (±6) cps, approximately 50 watts.
Weight	approximately 40 pounds.
Dimensions	8-3/4 in. high x 19 in. wide x 20-1/4 in. deep (overall depth behind front panel).

Table 1-2. Transistor Complement

Chassis	Reference Designation	Type	Function
A2, First IF Amplifier	Q1	2N3478	30 Mc Amplifier
	Q2	2N3478	30 Mc Amplifier
	Q3	2N3478	30 Mc Amplifier
	Q4	2N3478	30 Mc Amplifier
	Q5	2N3478	Buffer Amplifier
	Q6	2N3478	40 Mc Amplifier
	Q7	2N3478	
	Q8	2N3478	Crystal Oscillator
	Q9	2N3291	40 Mc Amplifier
	Q10	2N3291	VFO Amplifier
	Q11	2N3478	Buffer Amplifier
	Q12	2N3478	Buffer Amplifier
A3, Second IF Amplifier	Q1	2N3478	10 Mc Amplifier
	Q2	2N3478	10 Mc Amplifier
	Q3	2N3563	10 Mc Amplifier
	Q4	2N3563	10 Mc Amplifier
	Q5	2N3563	10 Mc Amplifier
	Q6	2N708	Buffer Amplifier
A4, Demodulator	Q1	2N3564	10 Mc Amplifier
	Q2	2N3564	Cascade Limiter
	Q3	2N3564	
	Q4	2N3564	Cascade Limiter
	Q5	2N3564	
	Q6	2N708	Cascade Limiter
	Q7	2N708	
	Q8	2N2218	Output Amplifier
	Q9	2N3133	
A5, Predetection Down Converter	Q1	2N708	Crystal Oscillator
	Q2	2N708	

continued

Table 1-2, cont'd

Chassis	Reference Designation	Type	Function
A5, Predetection Down Converter, cont'd	Q3	2N708	Isolation Amplifier
	Q4	2N708	Video Amplifier
	Q5	2N708	Video Amplifier
	Q6	2N3566	Buffer Amplifier
	Q7	2N3251	Video Amplifier
	Q8	2N697	Video Amplifier
	Q9	2N2218	Output Amplifier
	Q10	2N3133	
A6, AGC Amplifier	Q1	2N3251	AGC Amplifier
	Q2	2N3566	Buffer Amplifier
	Q3	2N3251	Buffer Amplifier
	Q4	2N706A	AGC Amplifier
	Q5	2N706A	Buffer Amplifier
	Q6	2N2218	Output Amplifier
	Q7	2N3133	
A7, Video Amplifier	Q1	2N3566	Video Amplifier
	Q2	2N3251	Video Amplifier
	Q3	2N697	Video Amplifier
	Q4	2N2218	Output Amplifier
	Q5	2N3133	
	Q6	2N3566	Video Amplifier
	Q7	2N3251	Video Amplifier
	Q8	2N697	Video Amplifier
	Q9	2N2218	Output Amplifier
	Q10	2N3133	
A8, Audio Amplifier	Q1	2N1308	Output Amplifier
	Q3	2N1309	
	Q2	2N1308	Audio Amplifier
A9, Power Supply Regulator	Q1	2N1701	Current Amplifier
	Q2	2N1183B	Current Amplifier
	Q3	2N706A	Voltage-Control Amplifier
	Q4	2N1192	Voltage-Control Amplifier
Main Chassis	Q1	2N443	Series Regulator
	Q2	40251	Series Regulator

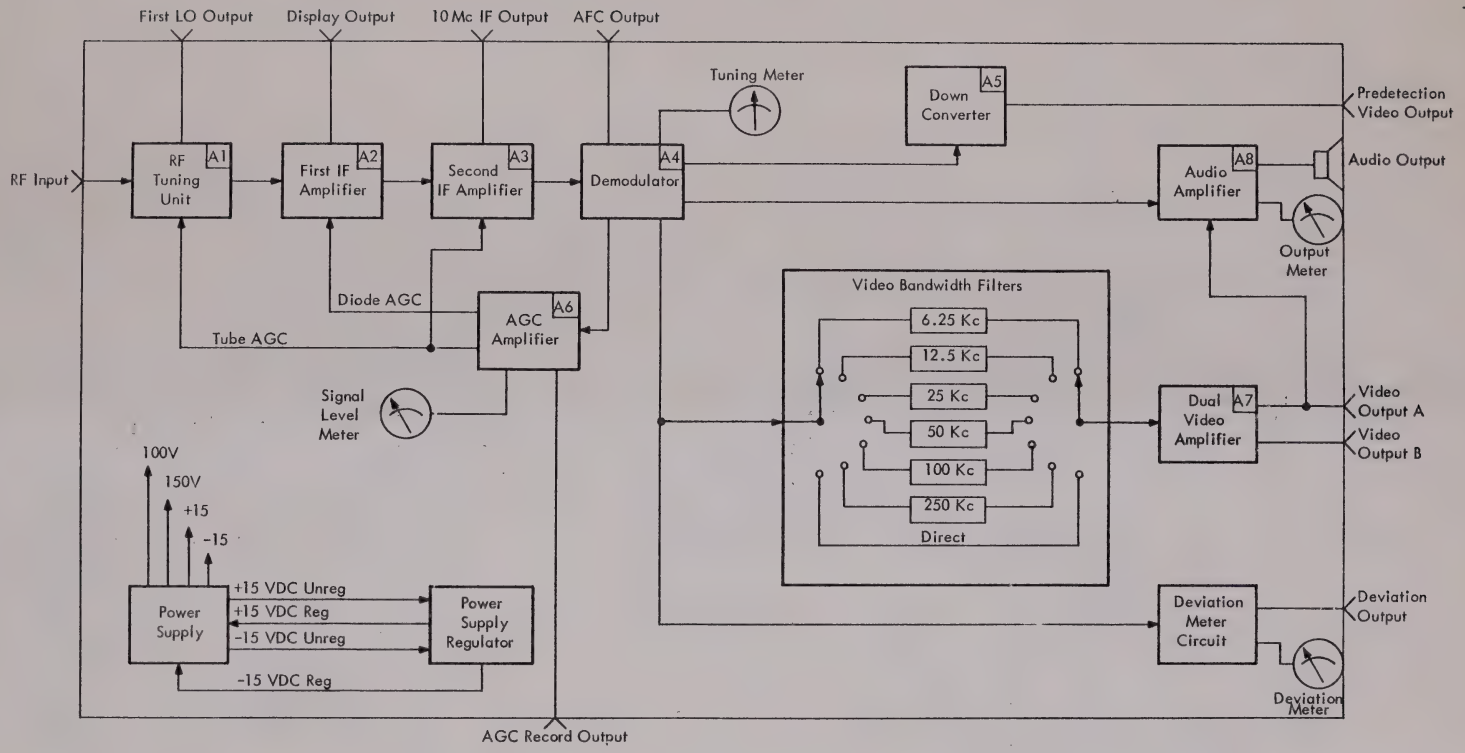
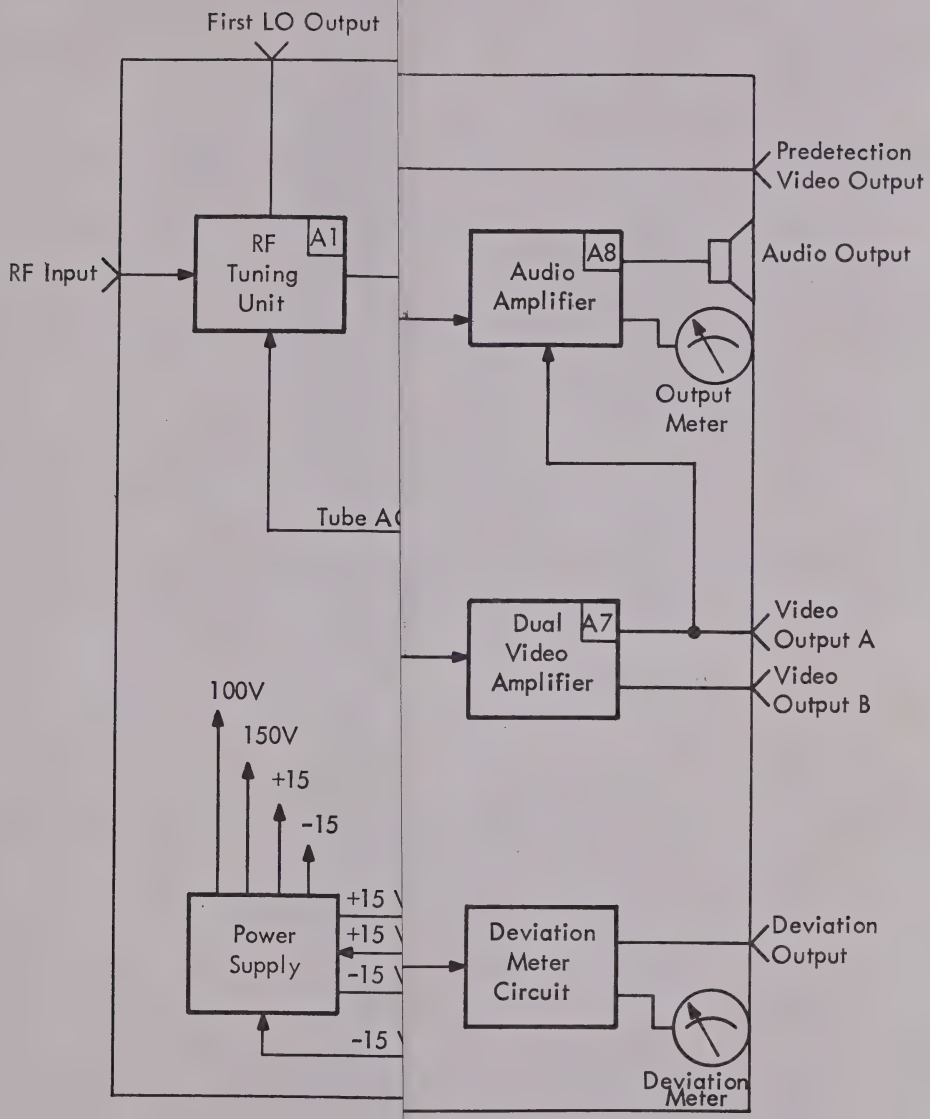


Figure 1-2. Model TMR-18B Telemetry Receiver Functional Block Diagram



2. Model TMR-18B Telemetry Receive
Functional Block Diagram

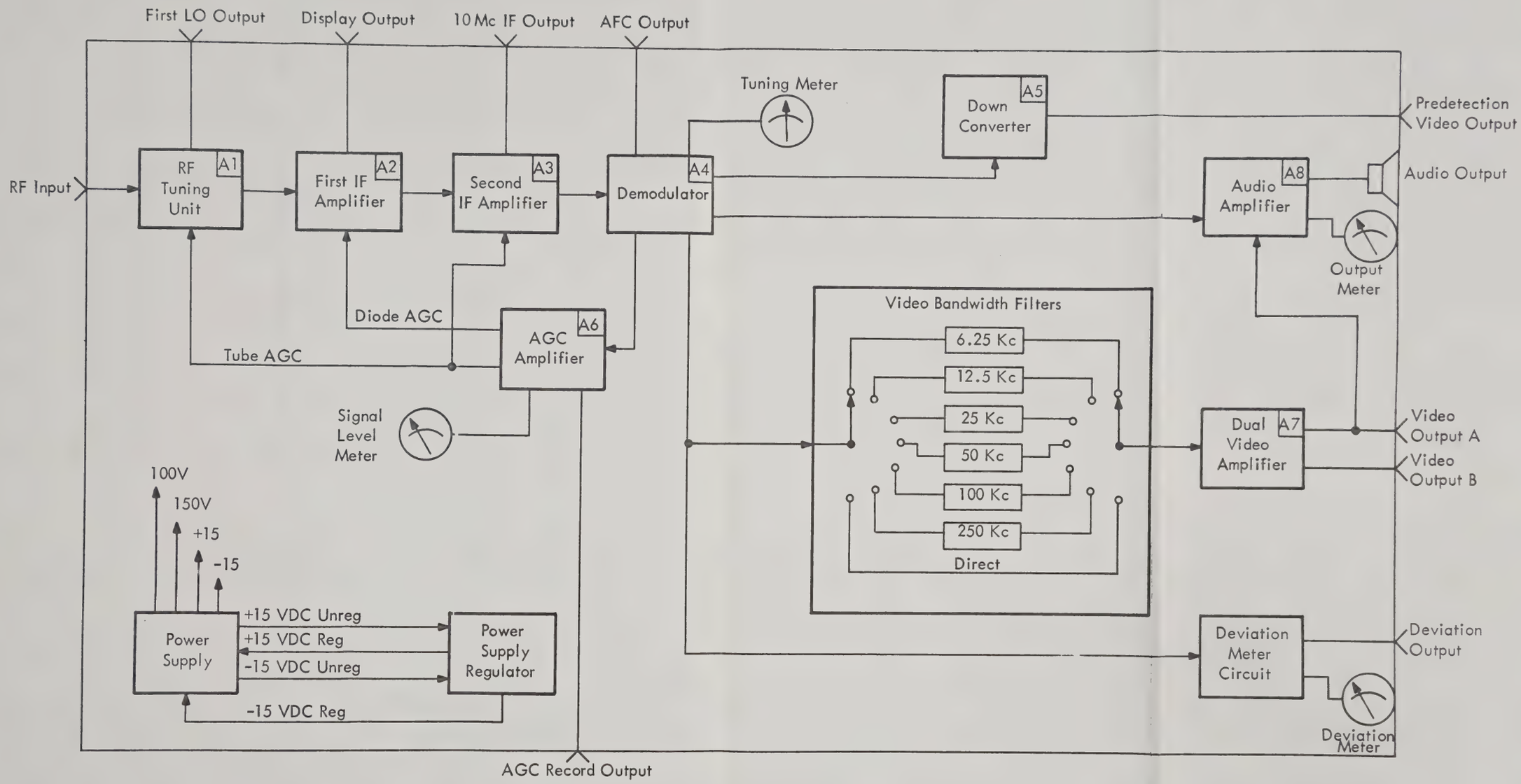


Figure 1-2. Model TMR-18B Telemetry Receiver Functional Block Diagram

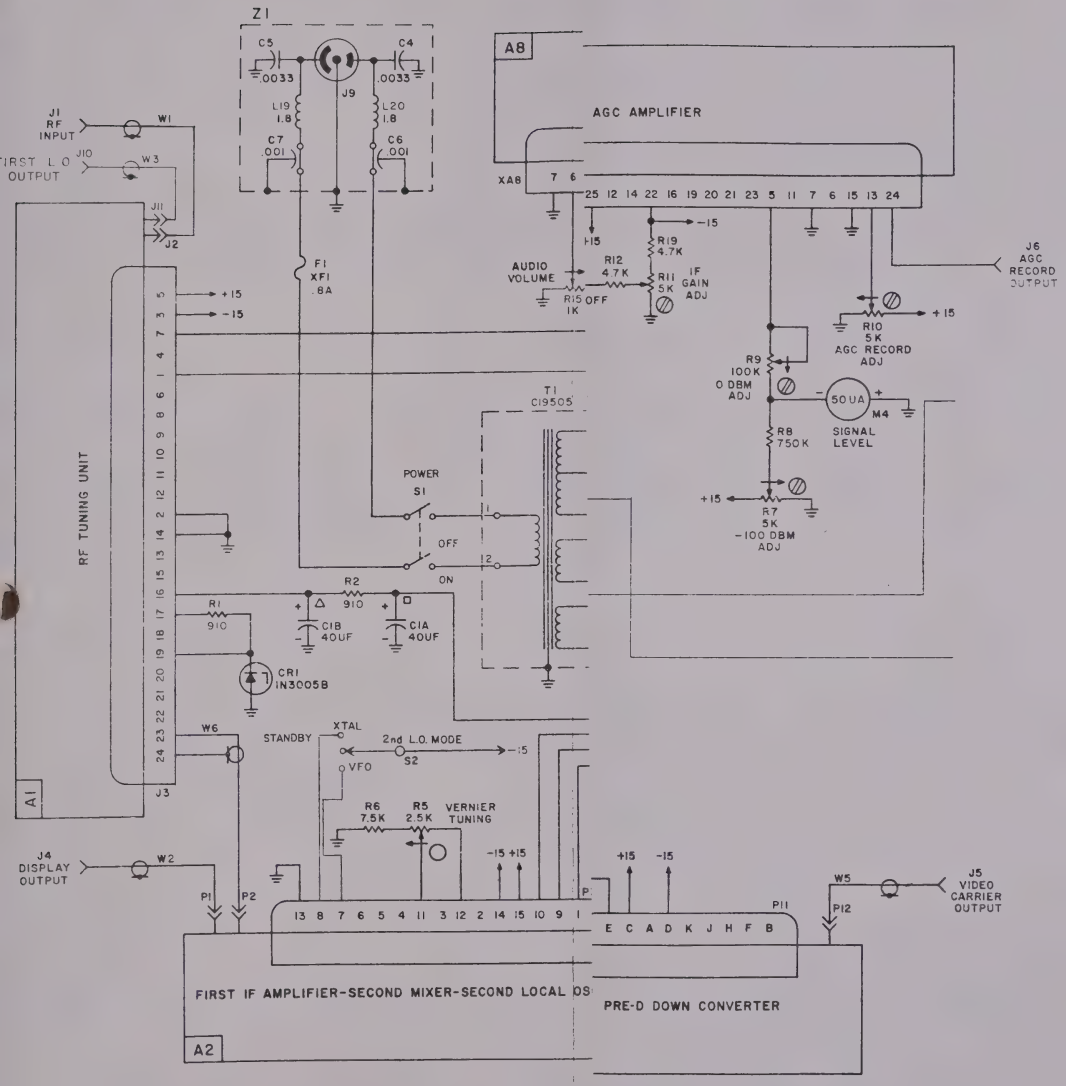


Figure 8-1. Model TMR-18B Telemetry Recei
Schematic Diagram R34266
Sheet 1 of 2

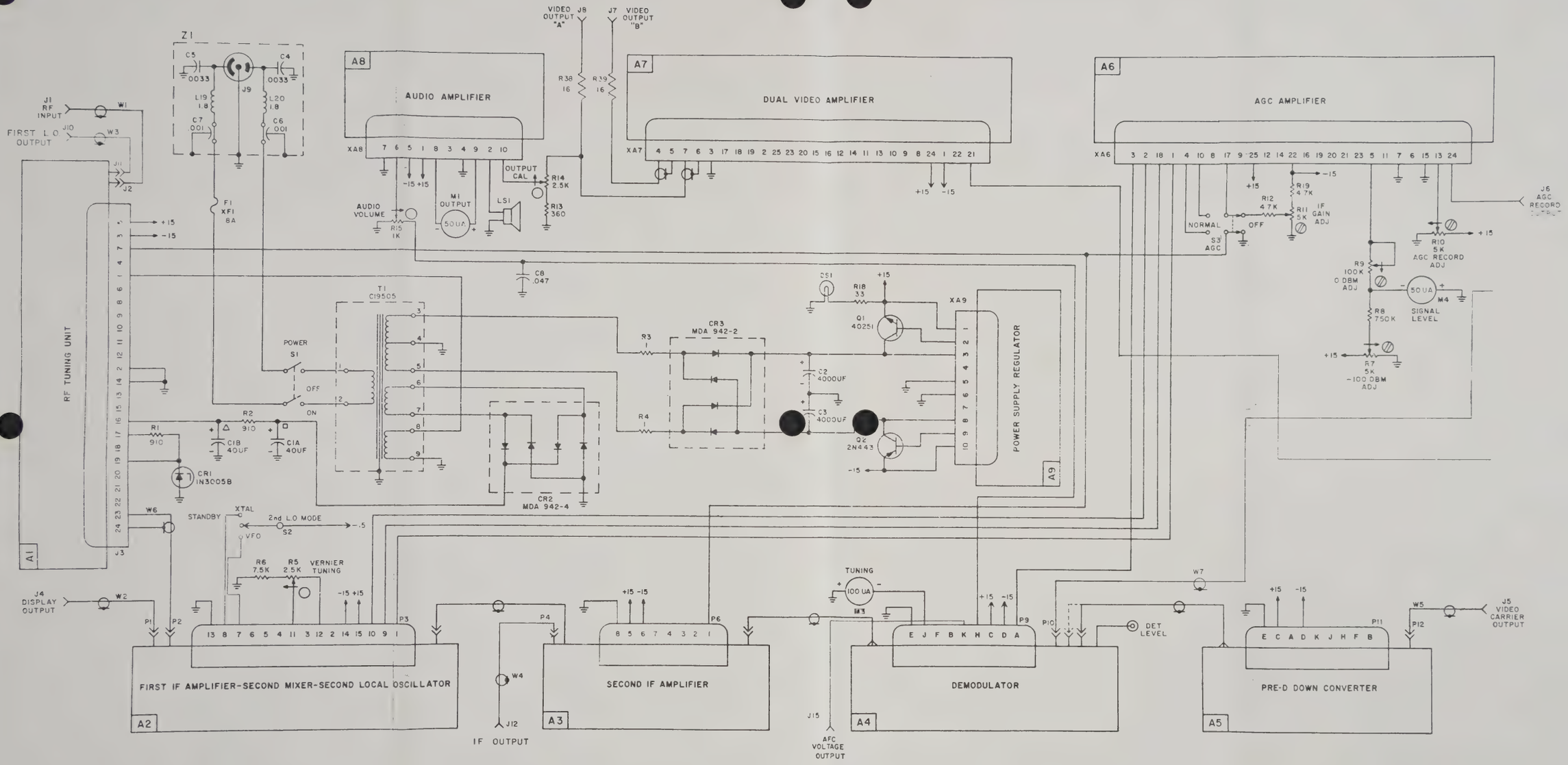


Figure 8-1. Model TMR-18B Telemetry Receiver, Schematic Diagram R34266 Sheet 1 of 2

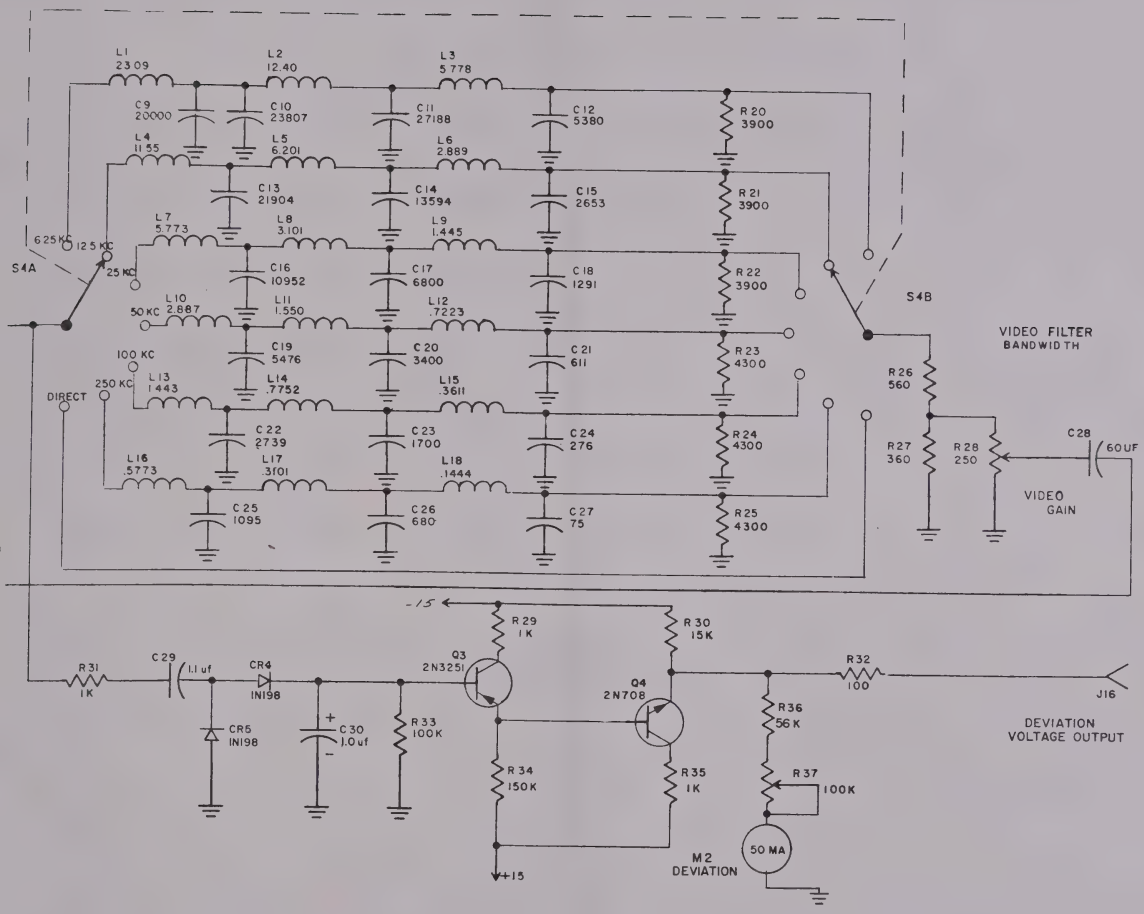


Figure 8-2. Model TMR-18B Telemetry Receiver, Schematic Diagram R34266 Sheet 2 of 2

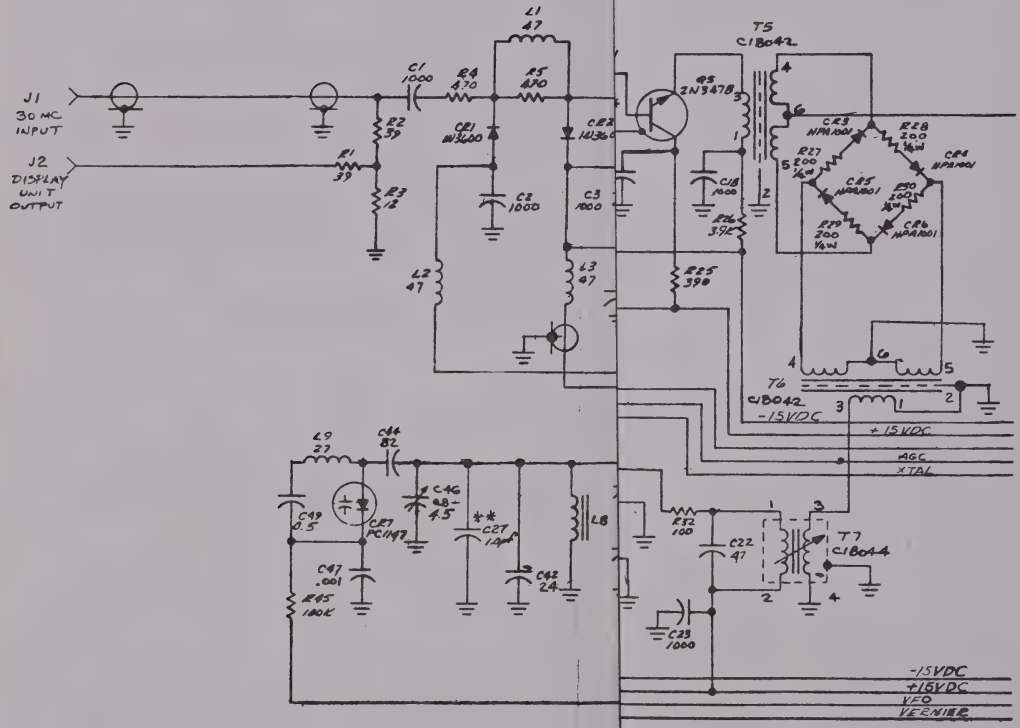


Figure 8-2. A2, First IF Amplifier Schematic Diagram R34112 Sheet 1 of 2

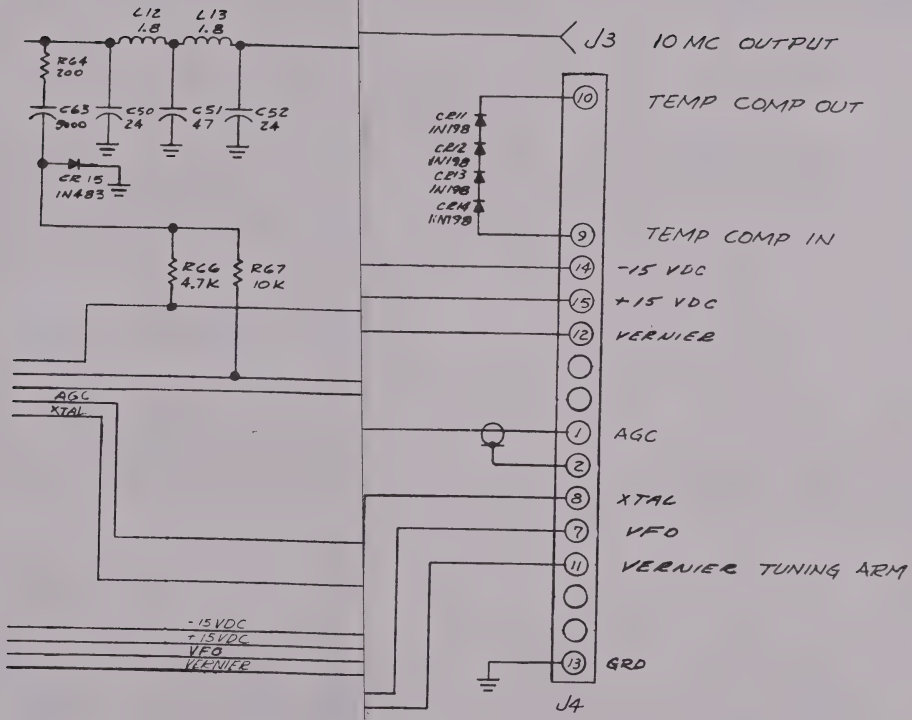


Figure 8-2. A2, First IF Amplifier, Schematic Diagram R34112 Sheet 2 of 2

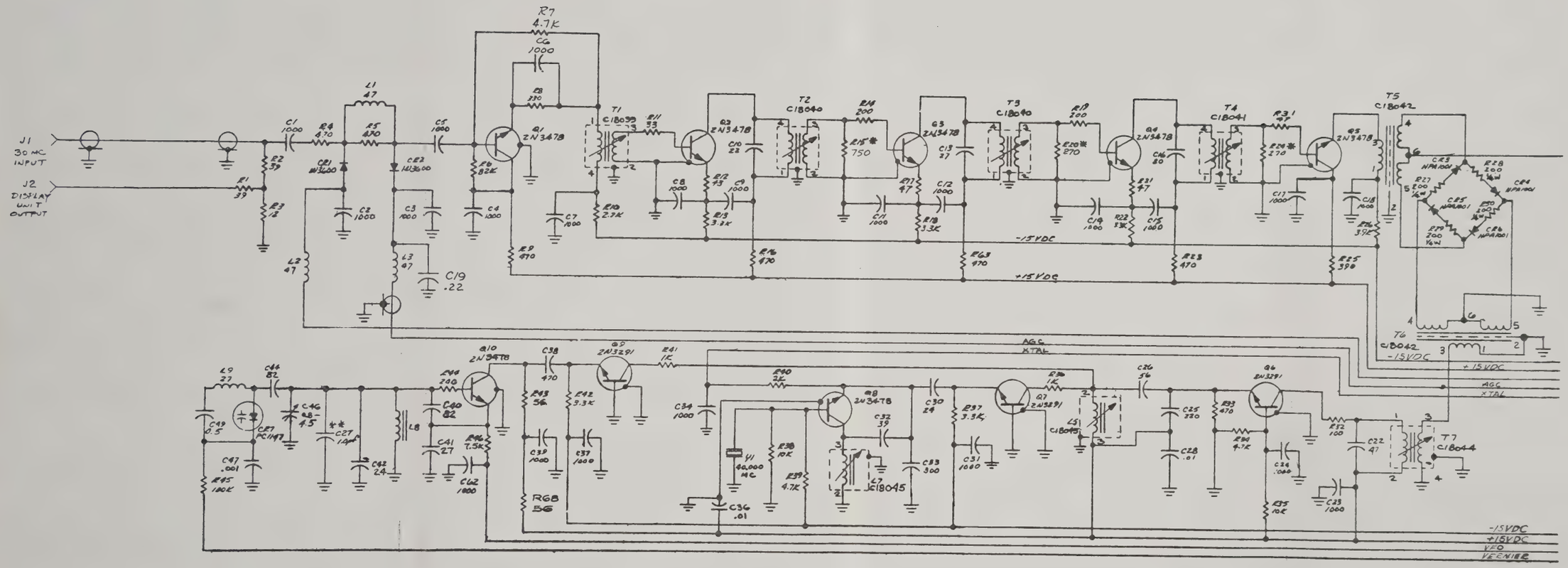


Figure 8-2. A2, First IF Amplifier
Schematic Diagram R34112
Sheet 1 of 2

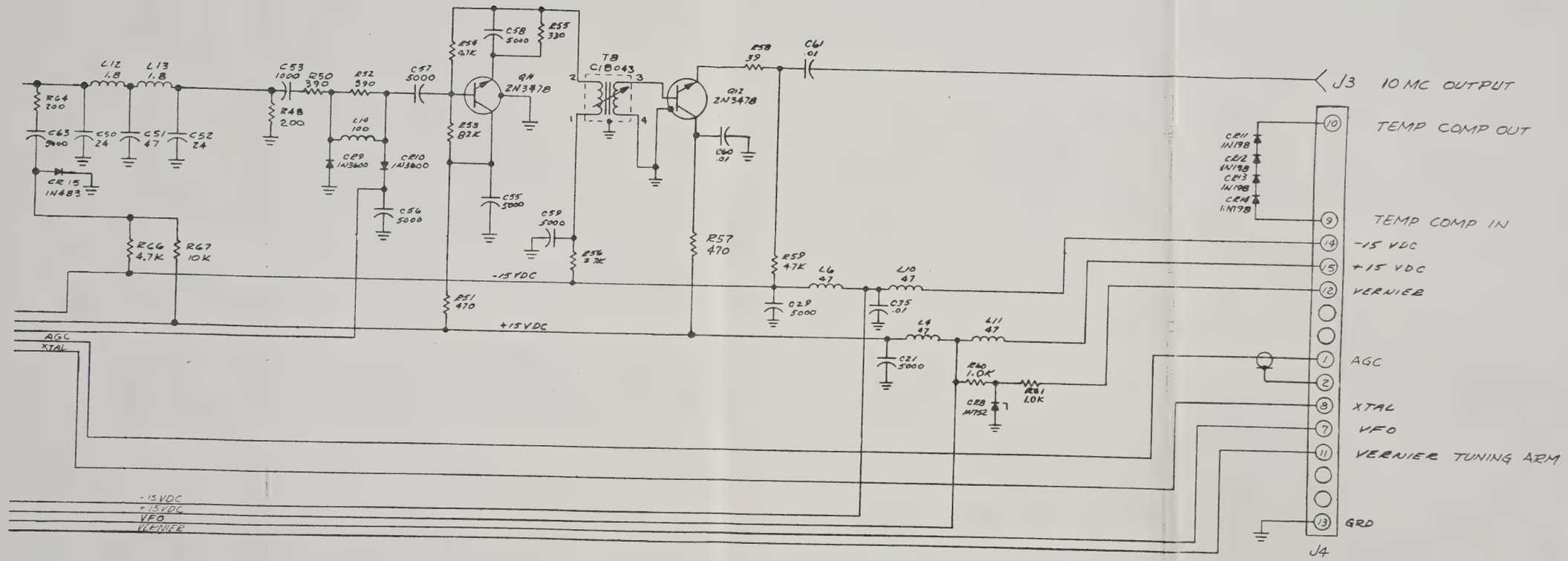
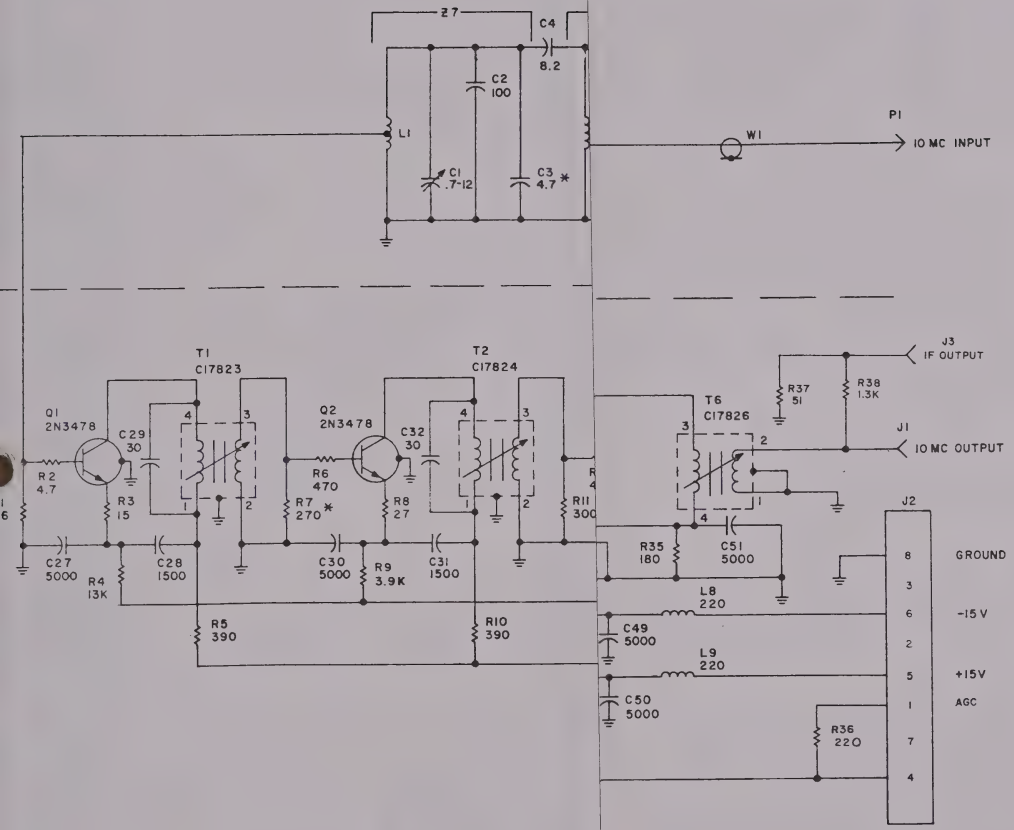


Figure 8-2. A2, First IF Amplifier, Schematic Diagram R34112 Sheet 2 of 2


Z7
C4
8.2
C2
100
L1
C1
.7-12
C3
4.7 *
W1
P1
10 MC INPUT
T1
C17823
T2
C17824
Q1
2N3478
C29
30
R2
4.7
R3
15
R6
470
R7
270 *
Q2
2N3478
C32
30
R8
27
R11
300
T6
C17826
J3
IF OUTPUT
R37
51
R38
1.3K
J1
10 MC OUTPUT
J2
C27
5000
R4
13K
C28
1500
C30
5000
R9
3.9K
C31
1500
R35
180
C51
5000
L8
220
C49
5000
L9
220
C50
5000
R36
220
R5
390
R10
390
8
GROUND
3
6
-15 V
2
5
+15V
1
AGC
7
4

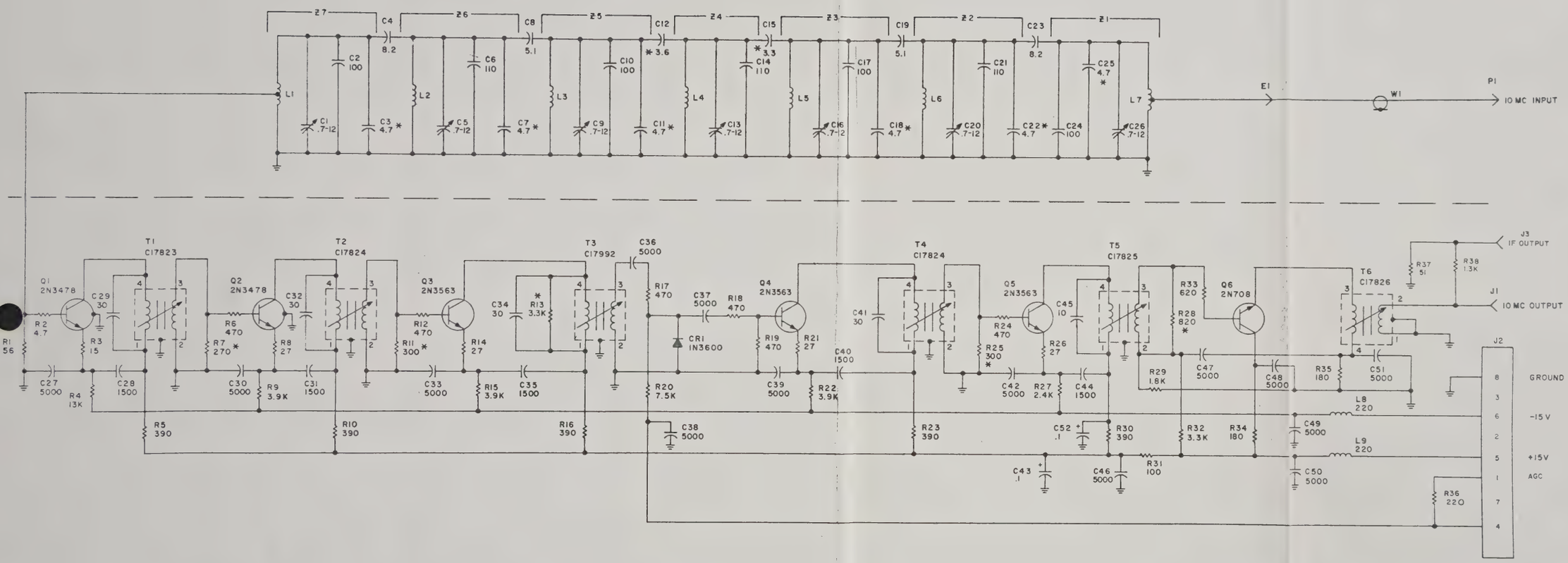
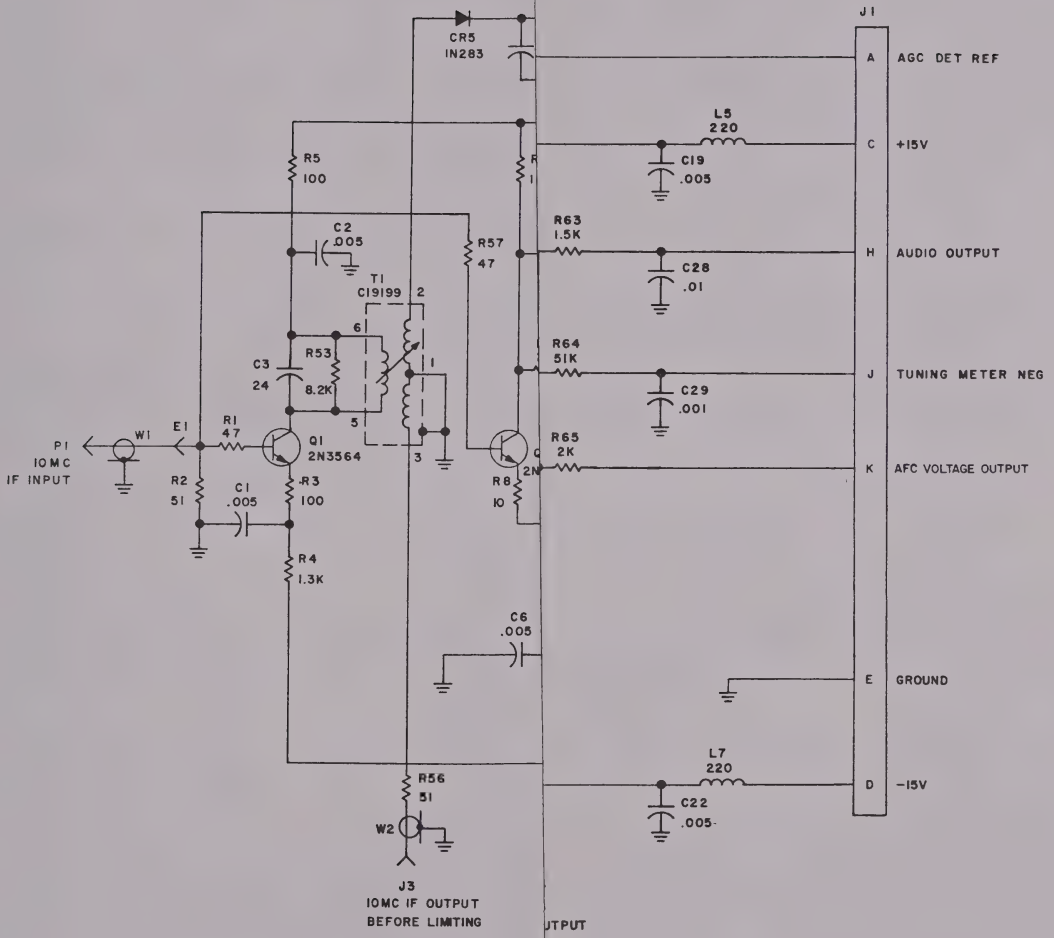


Figure 8-3. A3, Second IF Amplifier, Schematic Diagram R33826



gure 8-4. A4, FM Demodulator, Schematic Diagram R33874

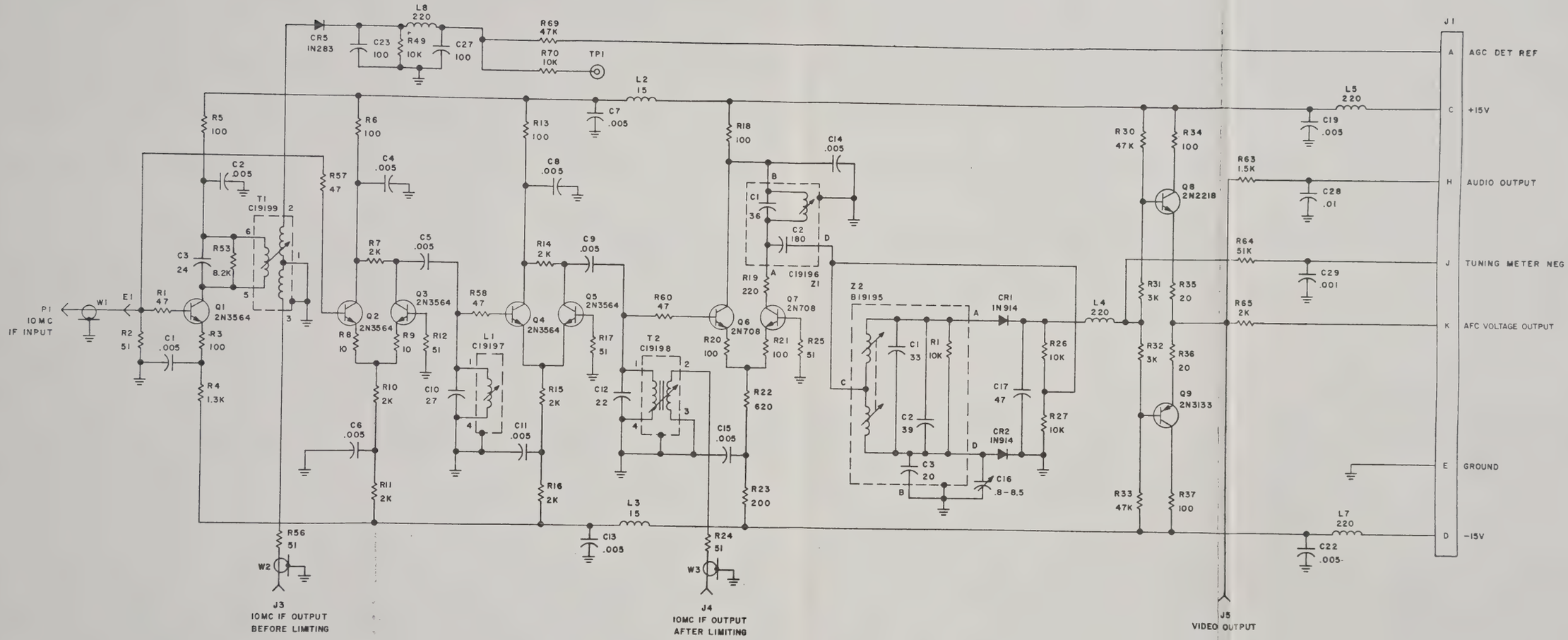
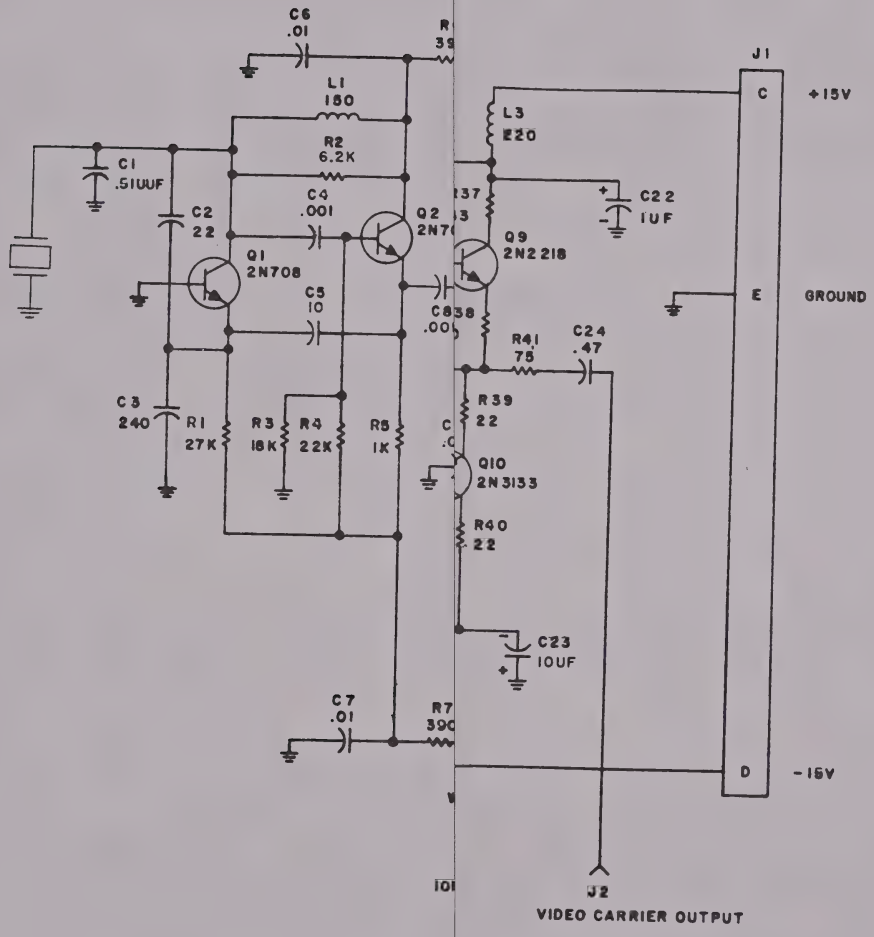


Figure 8-4. A4, FM Demodulator, Schematic Diagram R33874


C6
.01
L1
180
R2
6.2K
C1
.51UUF
C2
22
C4
.001
Q1
2N708
C5
10
C3
240
R1
27K
R3
18K
R4
22K
R5
1K
Q2
2N7
L3
E20
137
13
C22
1UF
Q9
2N2218
C838
.00
R41
75
C24
.47
R39
22
Q10
2N3133
R40
22
C23
10UF
C7
.01
R7
39
J1
C
+15V
E
GROUND
D
-15V
J2
VIDEO CARRIER OUTPUT

Y1
10.45000

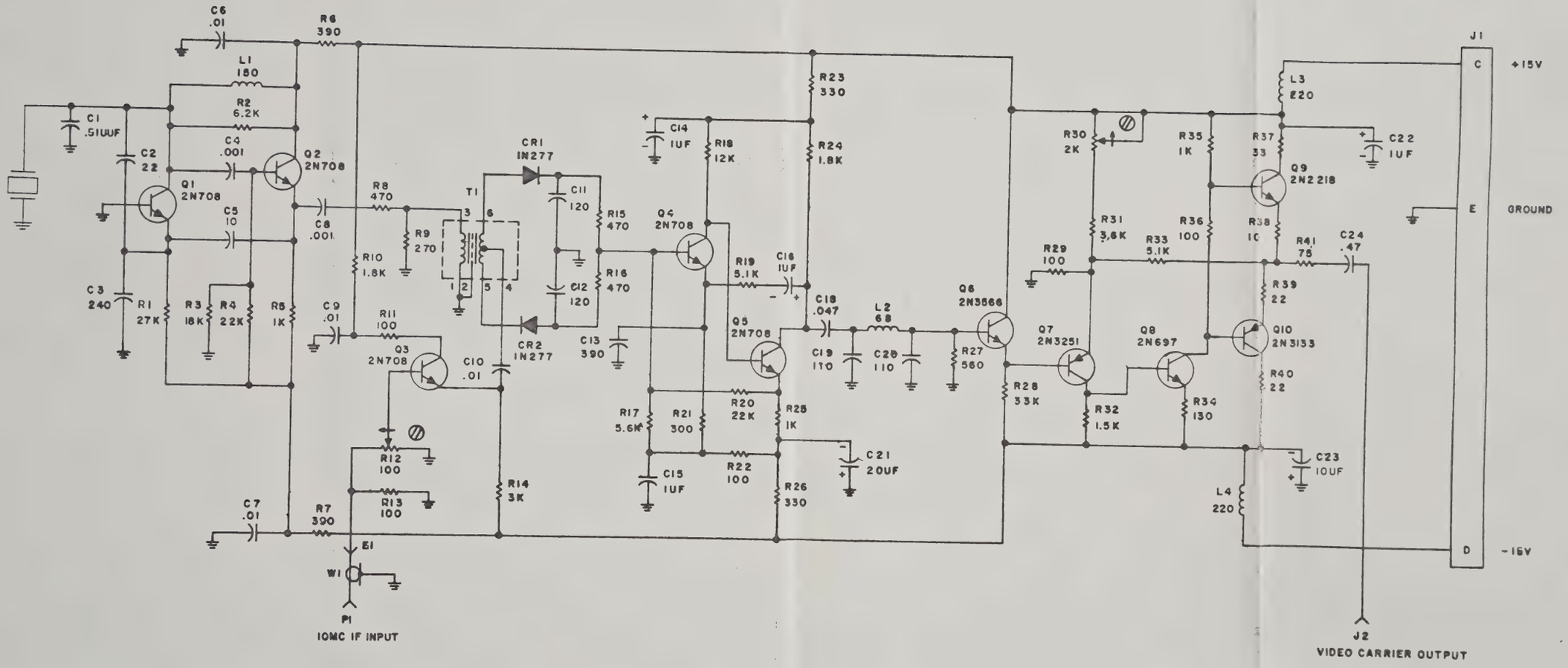


Figure 8-5. A5, Predetection Down-Converter, Schematic Diagram D33819

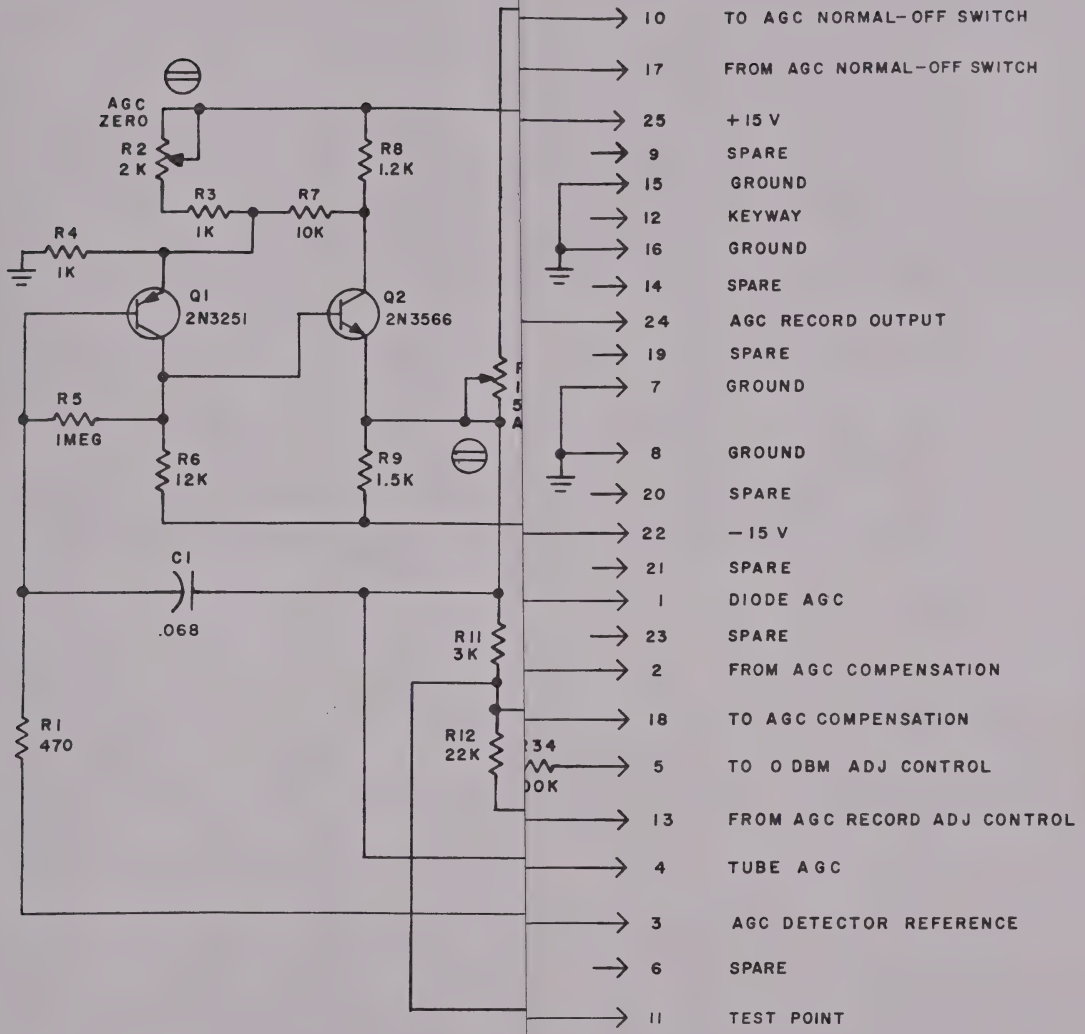


Figure 8-6. A6, AGC Amplifier, Schematic Diagram D31902

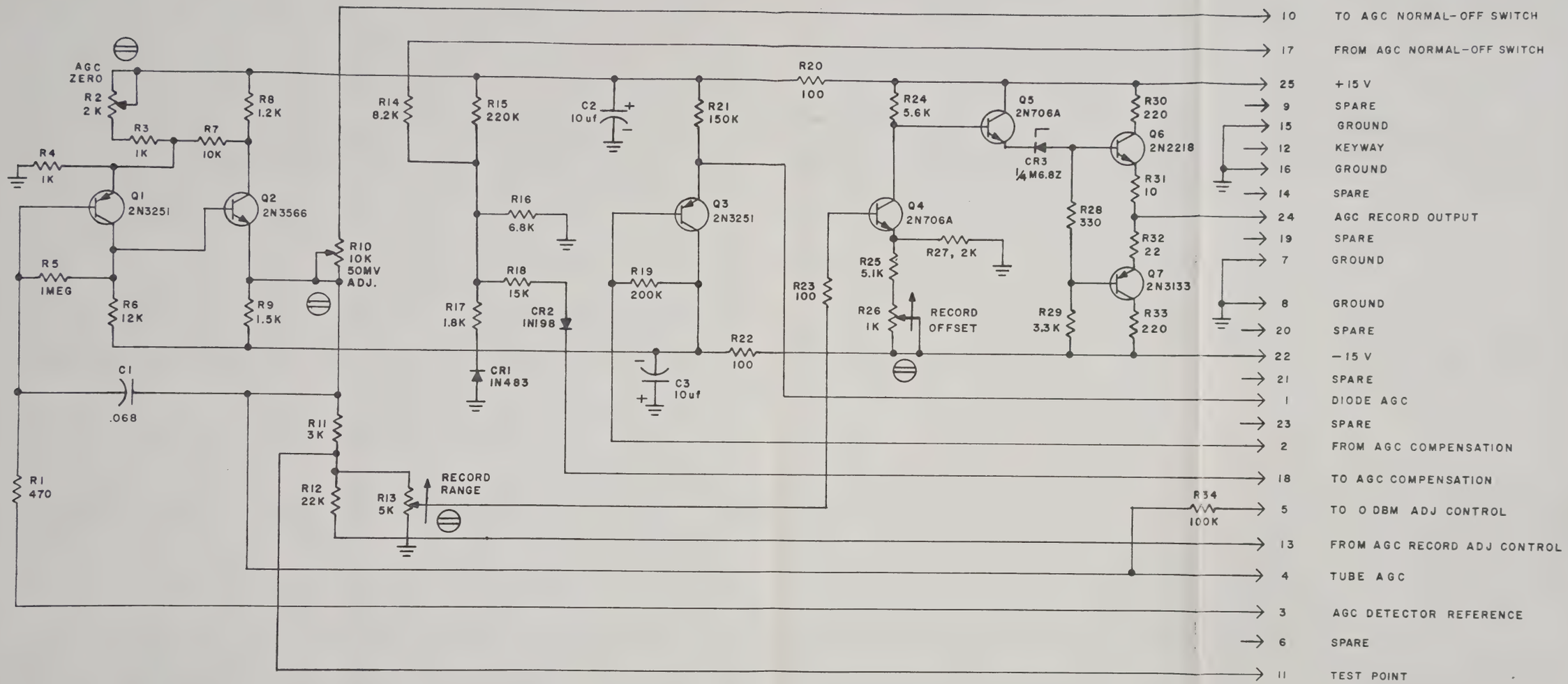
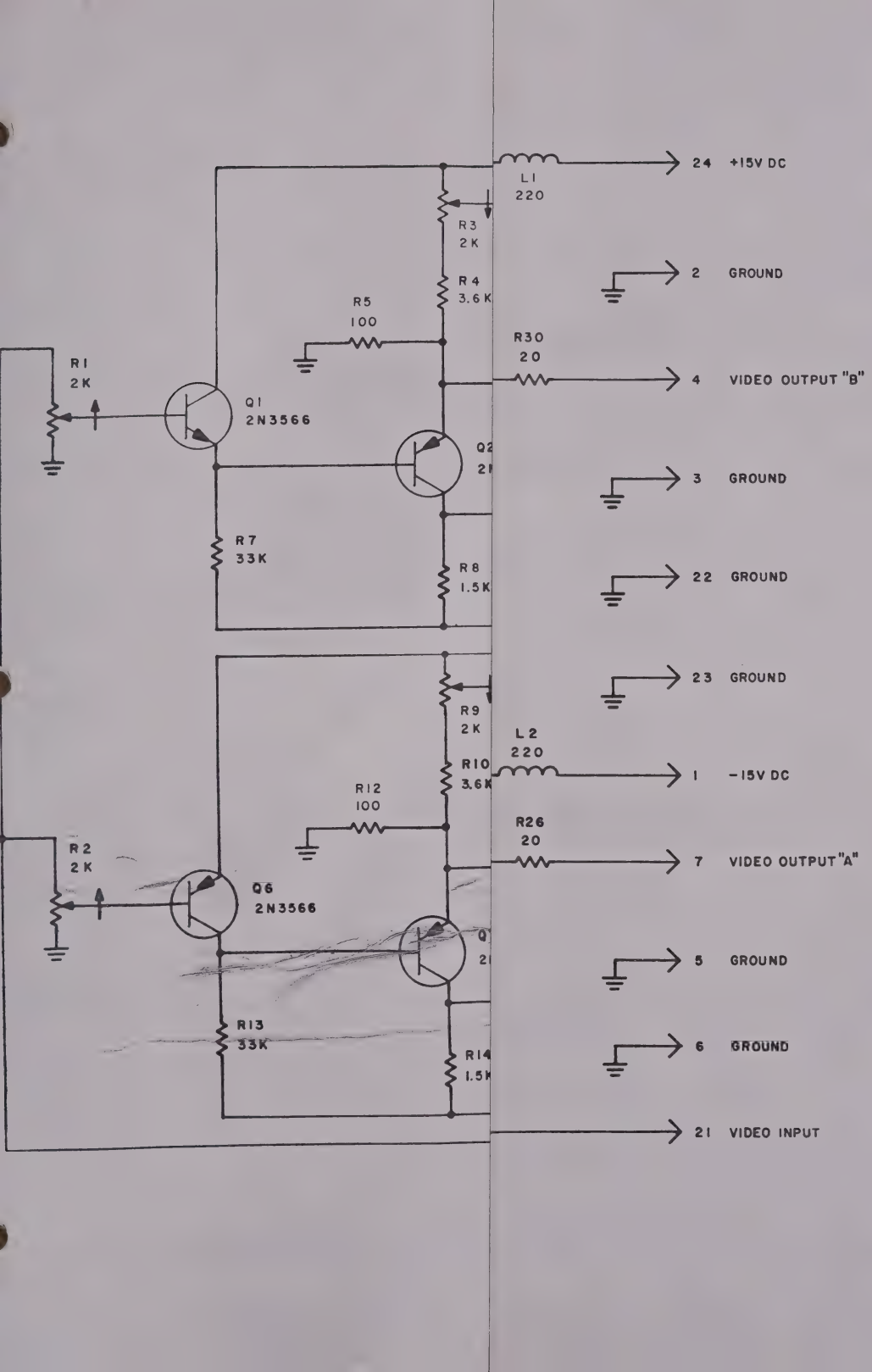


Figure 8-6. A6, AGC Amplifier, Schematic Diagram D31902


L1
220
24 +15V DC
R3
2K
R4
3.6K
2 GROUND
R5
100
R30
20
R1
2K
Q1
2N3566
4 VIDEO OUTPUT "B"
Q2
2N
3 GROUND
R7
33K
R8
1.5K
22 GROUND
23 GROUND
R9
2K
L2
220
R10
3.6K
1 -15V DC
R12
100
R26
20
R2
2K
Q6
2N3566
7 VIDEO OUTPUT "A"
Q
2
5 GROUND
R13
33K
R14
1.5K
6 GROUND
21 VIDEO INPUT

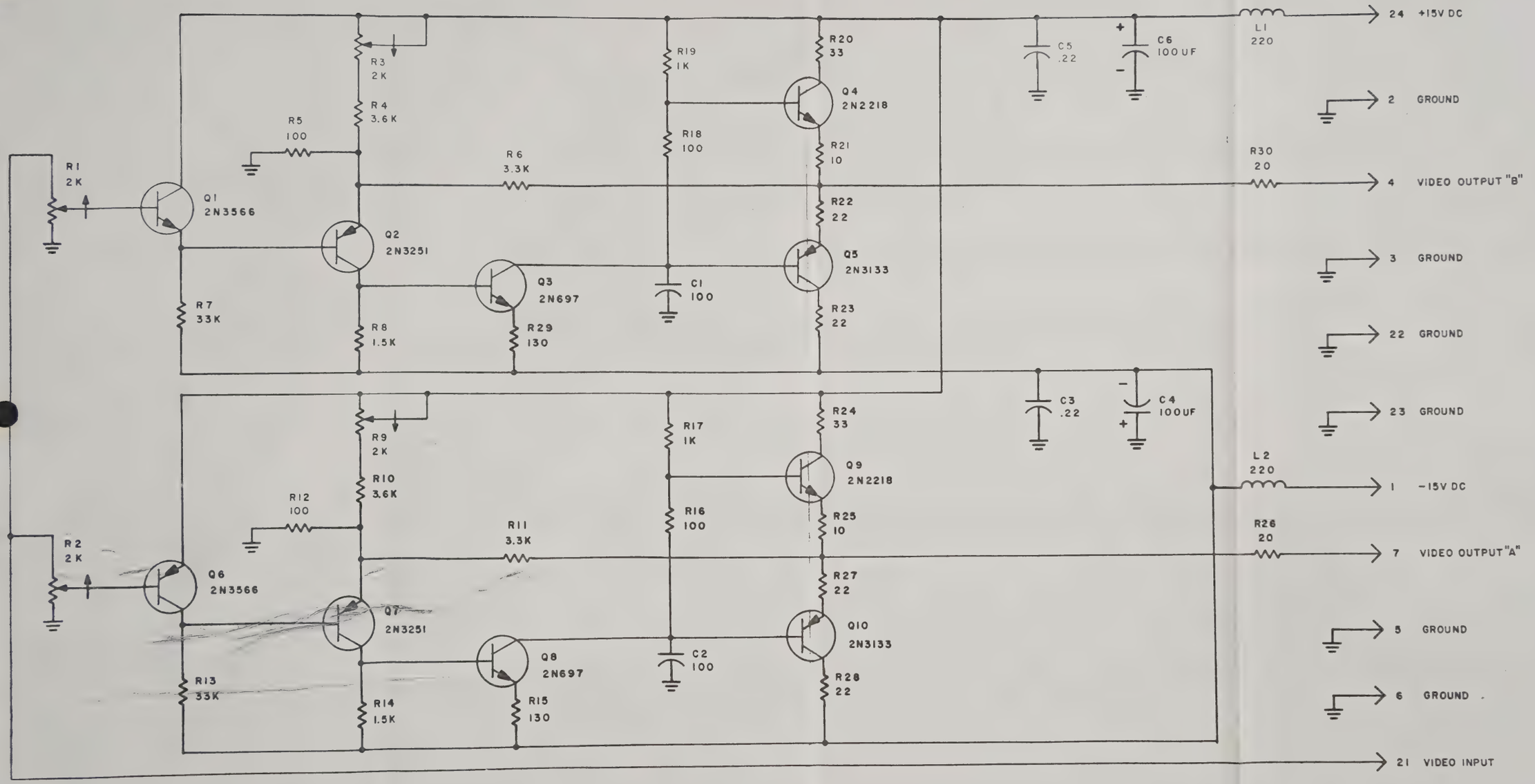


Figure 8-7. A7, Dual Video Amplifier, Schematic Diagram D31901

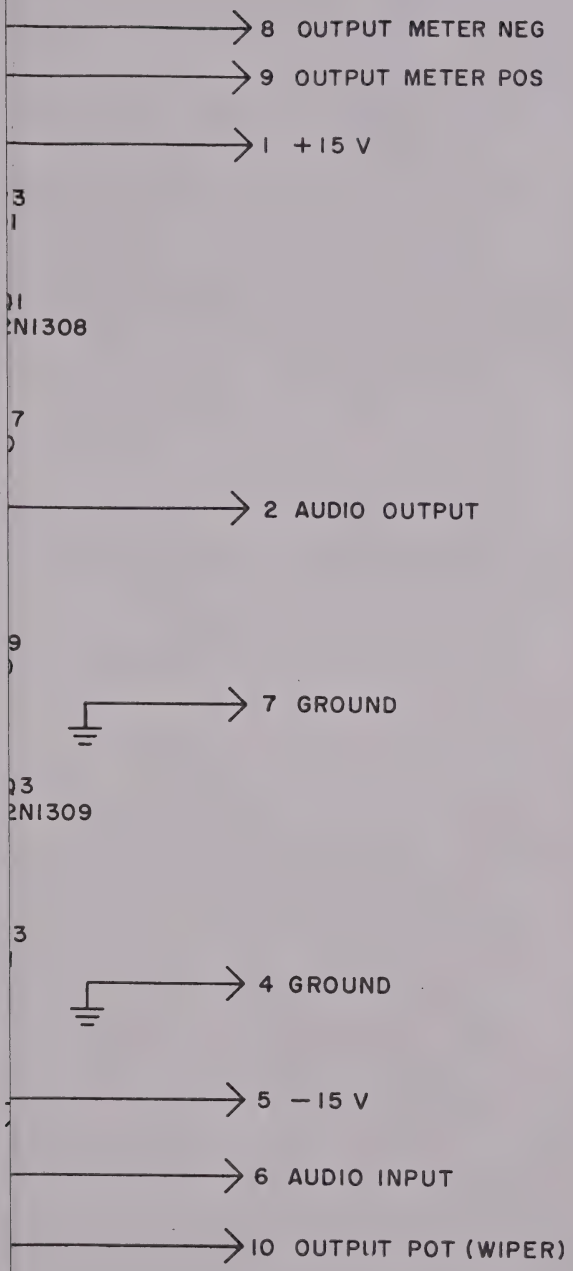


Figure 8-8. A8, Audio Amplifier, Schematic Diagram C31848

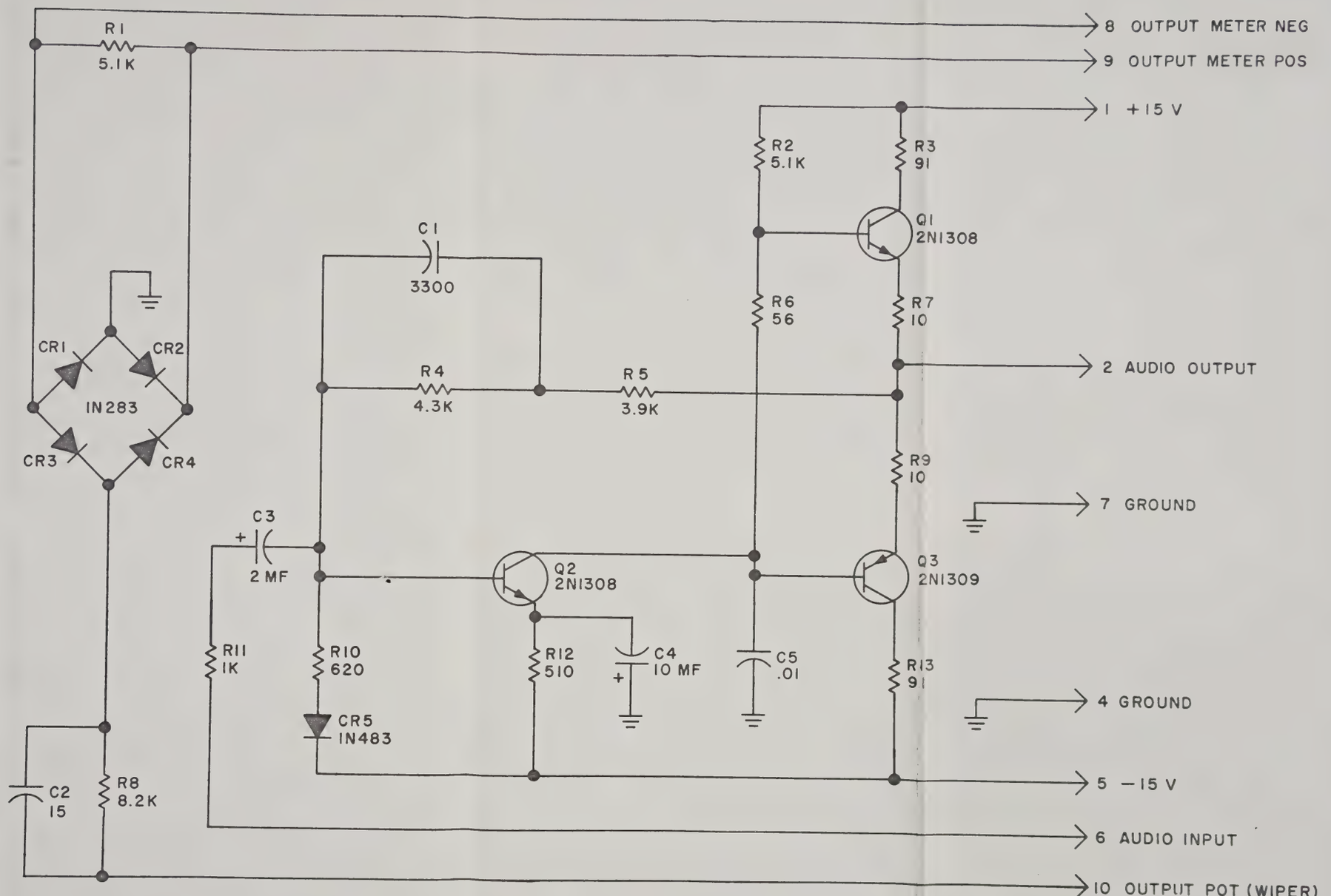
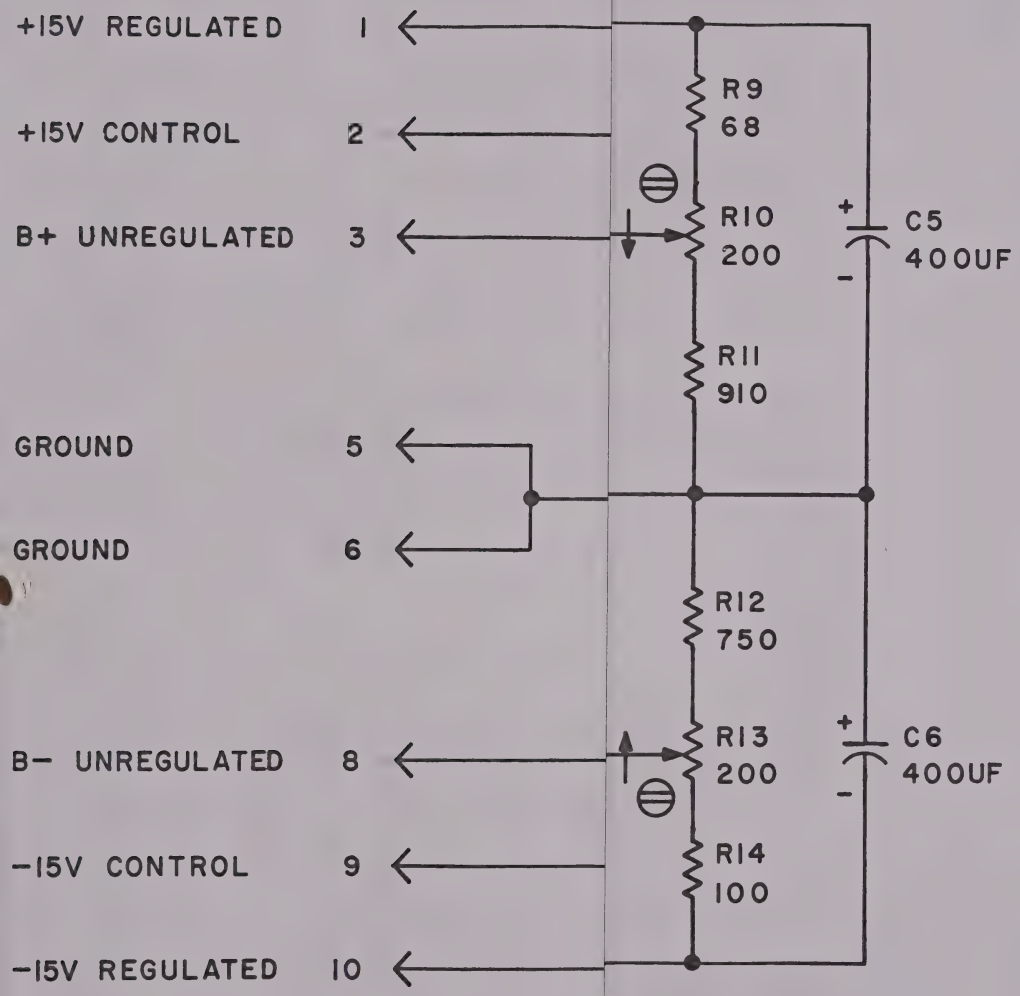


Figure 8-8. A8, Audio Amplifier, Schematic Diagram C31848


+15V REGULATED
1
+15V CONTROL
2
B+ UNREGULATED
3
GROUND
5
GROUND
6
B- UNREGULATED
8
-15V CONTROL
9
-15V REGULATED
10
R9
68
R10
200
R11
910
R12
750
R13
200
R14
100
C5
400UF
C6
400UF

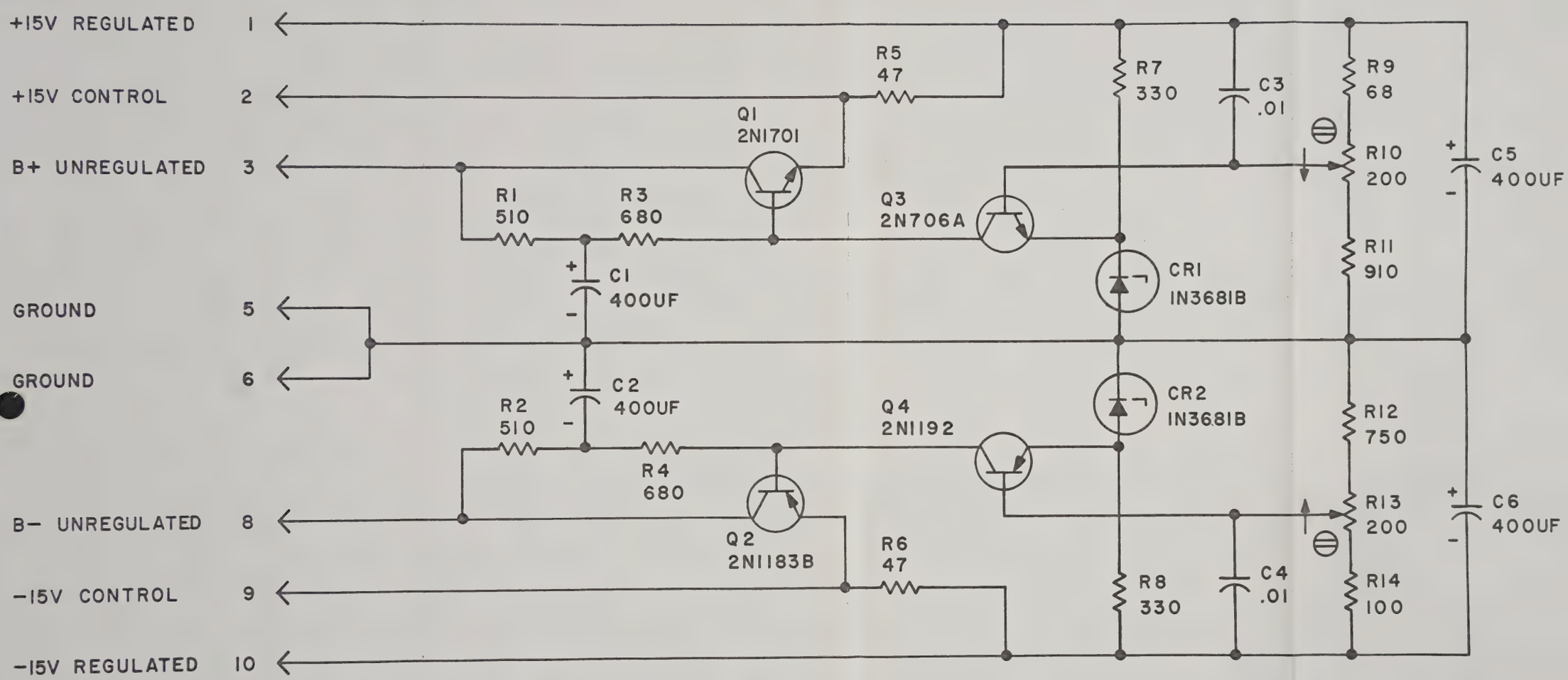


Figure 8-9. A9, Power Supply Regulator, Schematic Diagram D31883

SECTION II
PRINCIPLES OF OPERATION

2.1 GENERAL

The Model TMR-18B Telemetry Receiver is a double-super-heterodyne receiver designed to meet the highest performance needs of specialized telemetry applications throughout the frequency ranges of 215 mc to 260 mc, and 2200 mc, to 2300 mc.

Eight subassemblies, the rf tuning unit, and the main chassis interconnected as shown in figure 1-2 compose the receiver. Circuit analysis of the circuitry contained in each subassembly is presented in the succeeding paragraphs. For a detailed explanation of the rf tuning unit circuitry, refer to the instruction manual for that particular unit. The subassemblies employed in the receiver are as follows:

A2, first i-f amplifier (contains the second mixer and second local oscillator)

A3, second i-f amplifier (contains bandwidth filter)

A4, fm demodulator

A5, predetection down-converter

A6, agc amplifier

A7, dual video amplifier

A8, audio amplifier

A9, power supply regulator

To provide optimum interfaces, all rf and i-f input and output connections between subassemblies are designed for 50 ohm impedance.

Figure 1-2, the block diagram, shows the functional interconnections of the main circuits employed in the receiver. The schematic diagrams in Section VIII, used in conjunction with the block diagram will aid in gaining an understanding of the circuitry incorporated in the TMR-18B receiver.

2.2 CIRCUIT ANALYSIS

2.2.1 RF TUNING UNIT

Refer to the schematic wiring diagram of the main chassis shown in figure 8-1.

The rf input signal is applied to J1 on the rear apron of the main chassis. Coaxial cable W1, located in the main chassis, couples the signal to the rf tuning unit input. The rf tuning unit employs an rf amplifier or preselector/mixer, selectable variable frequency (vfo) and crystal oscillator, appropriate buffer stages,

a 30 mc preamplifier, and a multiplier chain. All receiver "front-end" circuitry from the rf amplifier or preselector to and including the first i-f buffer is contained in the tuning unit which provides an output signal of 30 megacycles.

The rf tuning unit incorporates a gain-set adjustment to allow standardization of rf tuning unit gain such that maximum input signal provides the desired level of 30 mc i-f output for the interface between the tuning unit and the first i-f amplifier in the main chassis. The rf tuning unit, designed to operate from a source impedance of 50 ohms, has an output impedance of 50 ohms for optimum interface with the first i-f amplifier subassembly, A2.

2.2.2 FIRST IF AMPLIFIER

Refer to the schematic diagram of the first i-f amplifier subassembly shown in figure 8-2. The first i-f amplifier consists of a 30 mc amplifier, the second local oscillators, the second mixer, and a 10 mc amplifier.

The 30 mc i-f signal from the rf tuning unit is applied across a resistive network, R1, R2, and R3, to a voltage-controlled attenuator CR1 and CR2. The resistive network is used as a voltage divider to provide a 30 mc i-f signal which may be applied to a display unit for monitoring purposes. This signal is made available at J2 on the rear apron of the main chassis. The subassembly operates from a source impedance of 50 ohms, provided by an interface amplifier in the rf tuning unit.

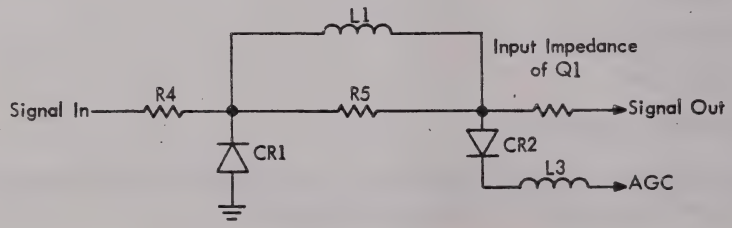


Figure 2-1. Voltage-Controlled Attenuator, Simplified Schematic Diagram

A simplified schematic of the voltage-controlled attenuator, which constitutes the gain-control network, is shown in figure 2-1. This voltage provides "straightline" linear attenuation which is not possible in transistorized circuits using conventional agc methods.

The amount of attenuation given the signal depends on the diode resistance, which is determined by the amount of current flowing in the circuit and is expressed mathematically by $R_d = \frac{26}{I_d\,(md)}$, where R_d is the diode resistance, and I_d is the diode current.

The diode current can be expressed as follows:

$$I = K,\ e^{K_2 V} \qquad (1)$$

$$\text{Log}_e I = K_3 V \qquad (2)$$

$$I_{db} = K_3 V \qquad (3)$$

From these equations, it can be determined that the current (in db) is proportional to the applied voltage, which is in this case the agc voltage. (See paragraph 2.2.7 for an explanation of the complete agc circuit.) As the agc voltage increases, the diode current also increases, reducing the diode resistance thereby producing an increase in the attenuation. An attenuation-in-db versus control-voltage plot gives an almost straight-line curve.

The attenuated signal from the network is applied to a five-stage 30 mc i-f amplifier which consists of Q1 through Q5. Tuned circuits are employed between each stage to produce a uniform response over a wide bandpass. The amplifier provides one of the two inputs to the second mixer; the other input to the mixer is provided by the second local oscillator. A crystal oscillator and variable frequency oscillator are provided as the second local oscillators. The selection of which oscillator is to be used is made through the second l-o mode switch which controls the operating voltages applied to the oscillators.

When the second l-o mode switch is in the XTAL position, operating voltage is applied to Q8, the 40-mc crystal oscillator. The signal generated by Q8 is applied through buffer amplifiers Q7 and Q6 to the mixer.

In the VFO mode of operation, operating voltages are applied to Q10, the variable frequency oscillator. The signal generated by Q10 is applied through buffer amplifiers Q9 and Q6 to the mixer. Fine tuning is provided in the VFO mode by the vernier control. A simplified schematic of the control circuitry is shown in figure 2-2. The vernier control is part of a voltage divider network connected

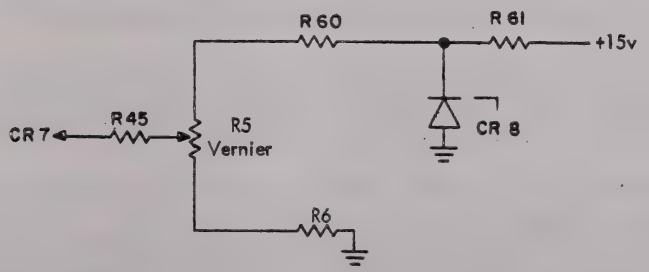


Figure 2-2. Vernier Control Circuitry, Simplified Schematic Diagram

between +15v and ground. The vernier control varies the amount of this voltage applied to CR7. CR7 is a voltage sensitive capacitor connected across the tank circuit of Q10. As the voltage applied to CR7 is varied by the vernier control, the reactance of CR7 is varied, changing the resonant frequency of the oscillator. The frequency of the tank circuit may be varied ±250 kc by the vernier control.

The mixer is a four diode balanced circuit composed of CR3 through CR6 with appropriate filtering at the output. The 10-mc output of the mixer is applied across a voltage-controlled attenuator of the type used in the input circuit. The attenuator drives a 10-mc amplifier, Q11, which in turn drives the emitter-follower output stage, Q12. Q12 drives the i-f filter, contained in the second i-f subassembly, and is operated into a 50 ohm impedance.

2.2.3 SECOND IF AMPLIFIER

Refer to the schematic diagram of the second i-f amplifier shown in figure 8-3. The second i-f amplifier consists of the second i-f bandwidth filter and a six-stage 10 mc i-f amplifier.

The i-f bandwidth filter, which determines the overall bandwidth of the receiver, comprises a seven pole lc network. The 10 mc i-f signal from the first i-f amplifier subassembly is applied to L7 which is tapped to provide the appropriate source impedance for the subassembly. The coupling capacitor values and the lc ratios of the poles are selected to effect a maximum uniformity of response with a 3 db bandwidth of 500 kc. The filter is designed to operate from a 50 ohm source impedance.

Inductor L1 in the last pole is tapped to provide the 50-ohm interface impedance required for the second i-f amplifier. The 10 mc i-f signal from the bandpass filter is applied to the first stage of a six-stage 10 mc i-f amplifier, consisting of Q1 through Q6. Resistor R1 and the input impedance of Q1 provide approximately 50 ohms of impedance to match the output impedance of the bandpass filter. Common emitter circuits are employed in the amplifier, with the exception of the output stage, which is an emitter-follower. Agc is applied to the fourth stage, Q4.

The agc voltage, fed through pin 1 of J4, is applied across a simple diode attenuator which functions in much the same manner as the voltage-controlled attenuators in the 30-mc i-f amplifier.

The 10 mc output signal from the second i-f amplifier subassembly is applied to the demodulator subassembly through J4 and to the rear apron of the receiver through J3.

2.2.4 FM DEMODULATOR

Refer to the schematic diagram of the fm demodulator shown in figure 8-4. The fm demodulator consists of a 10 mc amplifier, three two-stage limiters, a discriminator, and an output buffer amplifier. The characteristics of the fm demodulator are matched to those of the second i-f amplifier for optimum performance.

The 10-mc input signal is applied through P1 to the base of the 10-mc amplifier, Q1. Q1 is connected as a common-emitter with decoupling employed in the collector and emitter circuits. A signal is coupled from the resonant tank circuit in the collector and made available at J3 as the 10-mc linear output. Q1 also drives the cascade limiters and the agc detector.

A crystal diode, CR5, is employed as the agc detector. The signal is inductively coupled across T1 from the collector of Q1. The rectified output from the agc detector is coupled to J1-A and test point TP1 through a filter consisting of C23, C27, L8, and R49. The agc detector reference voltage, for application to the agc amplifier subassembly, is present at pin A of J1.

The limiter circuits are of unique design with three, two-stage, cascade circuits being used. The limiter circuits are Q2-Q3, Q4-Q5, and Q6-Q7.

Each circuit consists of an emitter-follower stage and a common-base stage. Operation of the two stages is similar to that of a flip-flop in that only one stage is conducting at a time, providing in effect full-wave limiting. The result is symmetrical limiting of the signal.

The first limiter receives its signal from the collector of Q1. The remaining limiters receive their driving signal from the emitter of the common-base stage of the previous limiter circuit. The tuned circuit in the base of Q4 serves as the load for Q3, and the tuned circuit in the base of Q6 serves as the load for Q5. A signal is coupled from the tuned circuit in the base of Q6 and made available after limiting at J4 as the 10-mc limited output.

A balanced phase-shift type Foster-Seeley circuit is used as the discriminator. The discriminator drives the buffer amplifier output stage, Q8 and Q9, which is complementary-symmetry circuit. The fm video output signal is taken from the emitter follower circuit and made available at J5 as the video output, for application to the video filter cards and to the deviation meter circuitry on the main chassis.

A sample of the fm video output signal is also made available at pin K of J1 and is applied to J15 on the rear apron of the receiver main chassis.

A portion of the video output signal from the discriminator also drives the tuning meter, which provides a zero indication when the receiver is precisely tuned to the received signal.

Tuning meter sensitivity is such that approximately 150 kc of detuning produces a full scale indication. This corresponds to approximately 7.5 kc per small division. The scaling permits a tuning meter indication of one or two small divisions of tuning error to occur before retuning is necessary. At the same time the tuning meter sensitivity is such that it is relatively easy to tune the receiver to the exact frequency. A deflection to the left of center on the tuning meter indicates

that the receiver is tuned to a signal lower in frequency than that being received; rotating the tuning control or the second l-o vernier tuning control in a clockwise direction corrects the tuning of the receiver to tune in the signal present.

An audio signal, from the junction of R35, R36, and R65 is made available at pin H of J1 for application to the audio amplifier subassembly.

2.2.5 DEVIATION METER CIRCUIT

Refer to the main chassis schematic diagram shown in figure 8-1.

The fm video signal from the demodulator is applied to a peak-minus-peak detection consisting of CR3 and CR4. The resultant dc voltage is applied to the deviation meter through a pair of emitter-followers Q1 and Q2. R37, located between the emitter of Q2 and the deviation meter, is provided for meter calibration purposes. A sample of the deviation voltage is made available at J16 on the rear panel of the receiver main chassis. The deviation meter is calibrated to indicate the amount of deviation present in kilocycles.

2.2.6 PREDETECTION DOWN-CONVERTER

Refer to the schematic diagram of the predetection down-converter shown in figure 8-5.

The predetection down-converter translates the 10-mc i-f signal from the demodulator subassembly to a 450 kc predetection video carrier frequency. Frequency translation is obtained by heterodyning the incoming 10-mc i-f signal with a crystal-controlled oscillator signal to produce a 450 kc difference frequency which is used as the video carrier.

The crystal oscillator, Q1 and Q2, employs a 10.450 mc crystal, Y1, as the tuning element. The oscillator signal is capacitively coupled from the emitter of Q2 to the primary of T1 by C8. The incoming 10-mc i-f signal appears across potentiometer R12, which is used to adjust the amplitude of the i-f signal applied via isolation amplifier Q3 and the center tap of T1 secondary to the balanced mixer (CR1 and CR2). The setting of R12 controls the output level of the video carrier. Present at the output of the balanced mixer, at the junction of R15 and R16, is the difference frequency between the crystal oscillator signal and i-f input signal.

Transistors Q4 and Q5 amplify the predetection video carrier frequency and apply the signal to a low-pass filter in the base circuit of emitter-follower, Q6. The low pass filter provides additional attenuation to all signals except the desired video carrier.

From the emitter of Q6, the video carrier frequency passes through two stages of amplification, Q7 and Q8, to a complementary symmetry output amplifier Q9 and Q10. The circuit configuration used provides the required high-input impedance as well as temperature compensation. The output amplifier provides the low output impedance required for the predetection down-converter output. The

amplifier, also, matches the output impedance of the converter to that of the input impedance of the recording equipment.

The predetection video carrier is available at J5 on the main chassis rear apron.

2.2.7 AGC AMPLIFIER

Refer to schematic diagram of the agc amplifier shown in figure 8-6. A simplified block diagram of the agc circuitry is presented in figure 2-3.

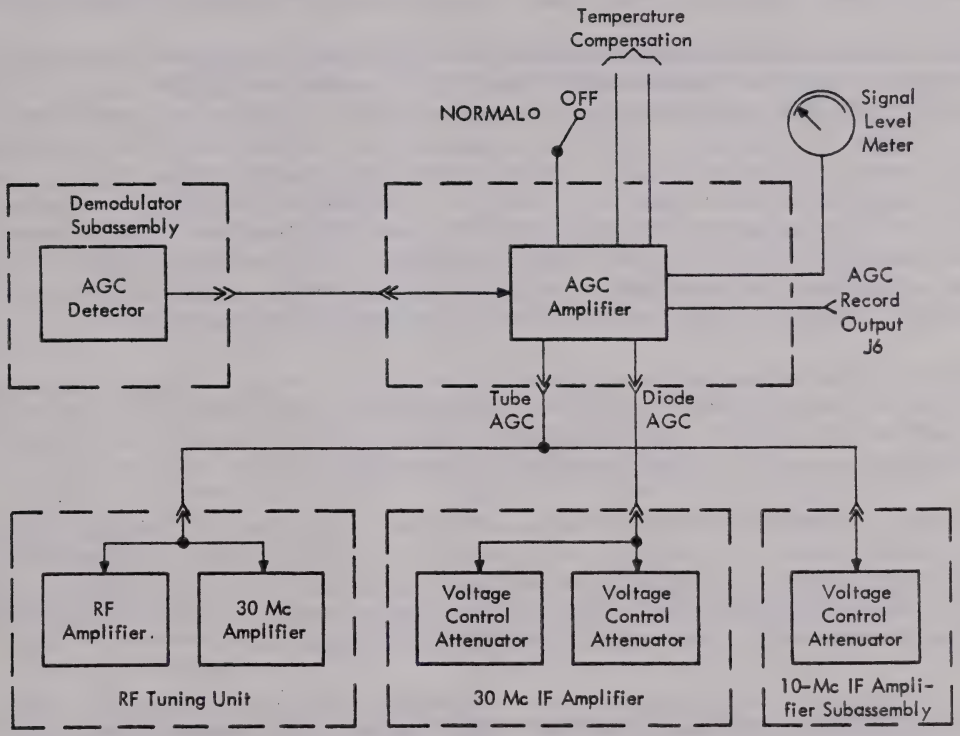


Figure 2-3. AGC Circuitry, Simplified Block Diagram

The agc amplifier provides the various agc voltages required in the operation of the receiver and drives the signal strength meter, M4. The agc amplifier subassembly produces two levels of agc voltage, diode and tube, from a single input voltage. The diode agc voltage is applied to the voltage-controlled attenuators in the first i-f amplifier subassembly. The tube agc voltage is applied to the rf tuning unit for control of the rf amplifier and the 30 mc i-f amplifier utilized within that unit. The tube agc voltage is also applied to the simple diode attenuator incorporated in the second i-f amplifier subassembly.

Agc voltage is obtained from an agc detector in the demodulator subassembly. The agc voltage is applied to an amplifier, Q1 and Q2, as the agc detector reference voltage. An agc zero control, R2, is incorporated in the emitter circuit of both Q1 and Q2. Essentially the control permits zeroing the agc level output when the proper agc level exists at the base of Q1.

The output of the agc amplifier is fed through R10, the 50 mv adjust, to S3 the agc normal/off switch on the main chassis. When a 0 db signal is applied to the receiver R10 is adjusted so that the agc voltage available at pin 4 of XA6 is -8 volts.

With the agc normal-off switch in the normal position, the agc voltage for the tubes is fed from the junction of R10 and R11 through pin 4 of XA6 and S3 to the rf tuning unit (A1) and to the diode attenuator in the second i-f amplifier (A3). This voltage automatically controls the gain of the respective circuitry according to the level of the input signal. The agc voltage developed across R10 is, also, fed through pin 10 of XA6 and S3 to pin 17 of XA6 where the voltage is applied to a positive peak detector, CR1 and CR2. The rectified positive voltage from CR2 is fed through pin 18 of XA6 to a diode temperature compensation network. The diode temperature compensation for the agc circuitry is located on the first i-f amplifier, second mixer, and second local oscillator subassembly.

From the diode temperature compensation network, the agc voltage is routed to the base of Q3 through pin 2 of XA6. The voltage is amplified by Q3 and is made available at pin 1 of XA6 as the diode agc signal for application to the voltage controlled attenuator in the first i-f amplifier subassembly.

When the agc normal-off switch is placed to the off position, a fixed agc level, controlled by the setting of R11, is present at pin 17 of XA6 for application to the diode temperature compensation network and amplifier Q3 for the diode agc voltage as previously described. The tube agc line normally connected to pin 4 of XA6 is disconnected and grounded by S3 in the off position.

An agc voltage for recording is taken across R13, the record range for application to a direct coupled amplifier Q4. This control is in series with the agc record adjust, R10, on the main chassis rear apron. By adjusting R10 and R13, to the proper setting, the agc voltage present at pin 24 of XA6 is -5 volts to +5 volts over the dynamic range of the receiver. Incorporated in the emitter circuit of Q4 is the record offset control R26. This control permits changing of the baseline of the agc recording signal available at pin 24 of XA6 to a -5 volts with no signal present. Amplifier Q4 drives a zener diode controlled emitter follower Q5. Zener diode CR3 regulates the level of the agc signal present from the output of complementary amplifier Q6-Q7. The agc signal present in the emitter circuit of the amplifier is available at the agc record output, J6, on the main chassis rear apron, for monitoring purposes.

2.2.8 VIDEO FILTERS

Refer to the main chassis schematic diagram shown in figure 8-1. Six video filters are provided to permit the selection of 3 db video bandwidths of 6.25 kc, 12.5 kc, 25 kc, 50 kc, 100 kc, and 250 kc. The only difference being in the component values. Three lc networks provide a six-pole, maximally-linear-phase response filter. The asymptotic slope of each filter is 36 db per octave. The filter configuration provides optimum square-wave response with the least possible overshoot. The video filter switch also has a direct position to facilitate the dual video amplifier alignment.

The video signal is applied to the filters through S4A, the video bandwidth selector switch, from the demodulator. The filtered video signal is applied through S4B to the dual-video amplifier input through R28, the video gain control, which is located on the main chassis.

2.2.9 DUAL VIDEO AMPLIFIER

Refer to schematic diagram of the dual video amplifier shown in figure 8-7. The dual video amplifier subassembly consists of dual video amplifiers, designated channel A and channel B. The circuitry contained in each channel functions identically, therefore, only the function of the circuitry composing channel A will be explained in the following discussion.

The filtered video signal is applied to the base of Q6, the first stage of the video amplifier. The signal is directly coupled between Q6, Q7, and Q8, the latter driving complementary amplifier Q9 and Q10. Q9 and Q10 are connected in a complementary-symmetry amplifier configuration. Feedback is employed between this stage and Q7 to maintain stability. An internal adjustment, R9, permits dc balancing of the amplifier.

The video output signal is taken from the emitter circuit of Q9 and Q10 applied through pin 7 of connector XA7 to the VIDEO OUTPUT A jack, J8, on the rear apron of the main chassis.

The video output A is also applied to a bridge rectifier, CR1 through CR4, in the audio amplifier subassembly through the output calibration control, R14, physically located in the main chassis. The rectified voltage from this bridge rectifier is applied to the output meter which indicates the relative signal level of the video output.

2.2.10 AUDIO AMPLIFIER

Refer to schematic diagram of the audio amplifier shown in figure 8-8. The audio amplifier accepts the audio signal from the demodulator subassembly, which is developed through the audio volume control, R15, physically located in the main chassis.

The audio signal is applied through pin 6 of XA8 to the base of Q2, which is connected as a common emitter amplifier. Q2 drives Q1 and Q3, which are connected in a push-push complementary amplifier configuration. The audio output is taken from the emitter circuit of Q1 and Q3 and applied to pin 2 for application to the speaker.

This subassembly, also, contains a bridge rectifier which receives a video output from channel A and rectifies it for application to the output meter.

2.2.11 POWER SUPPLY REGULATOR

Refer to the schematic diagram of the regulator subassembly shown in figure 8-9 and to the main chassis schematic diagram shown in figure 8-1.

The power supply regulator subassembly consists of two separate voltage regulators; a +15 vdc regulator and a -15 vdc regulator. The circuitry of each regulator perform identical functions; therefore, only the circuitry of the +15 volt regulator will be discussed.

The +15 volt regulator employs Q1, a type 40251 located on the main chassis, and Q1, a type 2N1701 located on the regulator subassembly, which constitute a Darlington series regulator. The series regulator is controlled with voltage amplifier Q2, a type 2N706A. The voltage amplifier takes a portion of the output voltage, amplifies it, and feeds it back to the series regulator. Therefore, if there is any change in the output voltage, the amplifier will initiate compensation by means of the series regulator.

Two adjustments are provided to set the output level of the regulator subassembly; R10 for the positive regulator and R13 for the negative regulator.

2.2.12 POWER SUPPLY

The 115 vac power input is applied to the main chassis through J9 of filter Z1. The primary circuit of T1 is protected from overload by fuse F1 and is controlled by POWER switch S1.

The power supply consists of two bridge rectifiers CR2 for the high voltage, and CR3 for the low voltage, the power supply regulator subassembly, and electrolytic capacitors, C1A and C1B.

The +150 vdc supply voltage from CR2 is applied to the rf tuning unit for its operation. Zener diode CR1, a 1N3005B, also provides 100 vdc regulated for application to some of the circuitry in the tuning unit.

SECTION III
OPERATION

3.1 INTRODUCTION

The Model TMR-18B Telemetry Receiver is designed to meet the highest performance needs of specialized telemetry applications. The TMR-18B utilizes two rf tuning units which permit a coverage for the frequency range of 215 mc to 260 mc and 2200 mc to 2300 mc. Before operating the TMR-18B the specific reception/record requirements at hand must be studied and the method of employing the receiver in the accomplishment of the task determined.

The applicable plug-in tuning unit should be installed, the equipment turned on, and a 30 second warmup time allowed before the setup procedures are initiated. The plug-in rf tuning unit may be removed or installed in a matter of seconds. Refer to paragraph 6-3, Section VI, for installation procedures. Certain adjustments should be performed prior to scheduled operation; see paragraph 4-4, Section IV.

The front-panel controls and indicators are to a large extent self-explanatory; however, as an aid to the operator, a brief functional description of each control and indicator is given in paragraph 3-2.

3.2 CONTROLS AND INDICATORS

3.2.1 MAIN CHASSIS

3.2.1.1 POWER. Line voltage of 115 vac is applied to the TMR-18B power supply causing the power indicator to illuminate when the POWER switch is placed in the ON position.

3.2.1.2 AUDIO VOLUME. This control permits the adjustment of the output level of the audio monitoring circuits.

3.2.1.3 SECOND LO MODE. This switch permits the selection of either the variable frequency or the crystal-controlled second local oscillator. A standby position is provided to disable both oscillators.

3.2.1.4 SECOND LO VERNIER TUNING KC. This control permits manual tuning (±250 kc) of the second local oscillator when the SECOND LO MODE switch is in the VFO position.

3.2.1.5 VIDEO FILTER BANDWIDTH. This switch permits the selection of the 3 db bandwidth of the video signal applied to the video amplifiers. A direct position is provided to bypass the filters.

3.2.1.6 VIDEO GAIN. This control permits the adjustment of the video output level of both channels A and B.

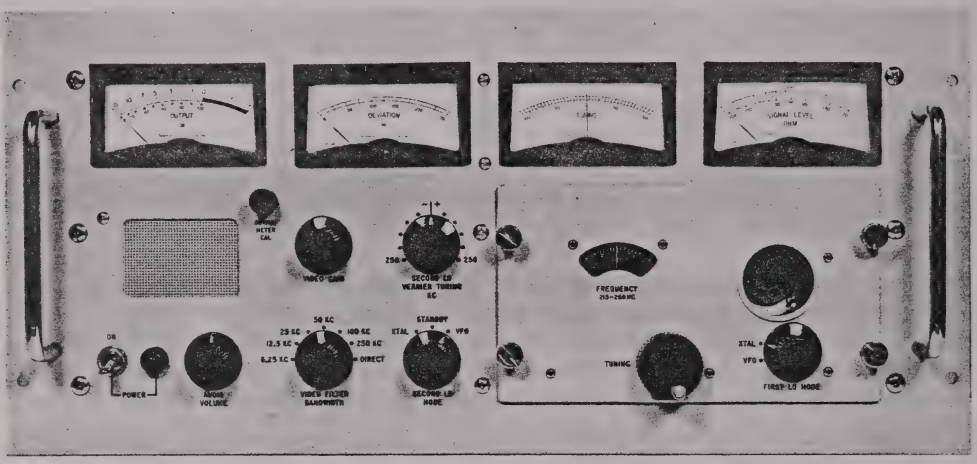


Figure 3-1. Model TMR-18B Telemetry Receiver, Front Panel View

3.2.1.7 OUTPUT METER CALIBRATE. This control permits the adjustment of the output meter for a zero db reference indication. Setting of this control has no effect on the actual video level at the video output of either channel A or B.

3.2.1.8 OUTPUT METER. This meter provides an indication of the relative output level of the video signal level present at VIDEO OUTPUT A connector on the main chassis rear apron.

3.2.1.9 DEVIATION METER. The deviation meter indicates the peak frequency deviation of the fm signal at the output of the demodulator subassembly. The DEVIATION meter is calibrated by R37, physically located on the receiver main chassis. R37 is accessible from the bottom of the unit when the bottom cover is removed.

3.2.1.10 TUNING METER. This meter provides an indication for precise tuning of the receiver to the received signal when the operator varies the TUNING control.

3.2.1.11 SIGNAL LEVEL METER. This meter provides an approximate (±6 dbm) indication in dbm above noise of the signal level present at the rf input. The signal level meter is calibrated in two scales due to the difference in agc characteristics between the vhf and uhf tuning units. The signal level meter should be calibrated each time the receiver is used with a different tuning unit so that the meter provides an accurate indication of the received signal level. Refer to paragraph 4.4.3 for this adjustment.

3.2.2 RF TUNING UNIT

3.2.2.1 TUNING. This control permits manual tuning of the rf amplifier or preselector/mixer, multiplier chain, and the first local oscillator during VFO operation. The TUNING control permits manual tuning of the rf amplifier or preselector/mixer and multiplier chain during XTAL operation.

3.2.2.2 FIRST LO MODE. This switch enables the selection of the mode of operation of the first local oscillator. The XTAL position is used when the crystal oscillator mode of operation is desired. The VFO position is used when the variable frequency oscillator mode of operation is desired.

3.2.2.3 FREQUENCY DIAL. The frequency dial indicates in megacycles the frequency to which the receiver is tuned.

3.2.3 CONTROLS ACCESSIBLE ON THE REAR APRON

3.2.3.1 AGC NORMAL/OFF. The AGC NORMAL/OFF switch is accessible from the rear apron. This switch permits the selection of either the normal agc source, or a fixed gain source. Should the OFF mode of operation be selected, the agc source may be manually adjusted by varying the IF GAIN ADJUST accessible with the top cover removed.

3.2.3.2 AGC RECORD ADJUST. This control permits the adjustment of the AGC RECORD OUTPUT level. With no signal being received, the AGC RECORD ADJUST control is adjusted for -5 volts dc at the AGC RECORD OUTPUT connector.

3.3 NORMAL OPERATION

The unit utilizes two rf tuning units to cover its operating range; choose the applicable rf tuning unit, determined by the task to be performed. Install the desired tuning unit as instructed in paragraph 6-3. If the receiver is rack mounted, ensure the front panel is flush against the rack and the slide assembly is locked. Investigate to determine that the desired cables are connected to the appropriate connectors on the chassis rear apron. (Refer to paragraph 6-3, Section 6.) If the rf tuning unit employs a crystal, ensure the crystal oven is properly installed in the octal socket.

No set sequence control settings is necessary when operating the receiver, however, certain recommended operating practices should be observed. For operating procedures using one of the optional rf tuning units, refer to the instruction manual for that specific unit.

a. Ensure that all required cables are connected. Apply 115 vac input power to the receiver by placing the POWER switch to the ON position. Allow a 30-second warmup period.

b. Place the FIRST LO MODE switch to the desired mode of operation. If the XTAL mode is selected, ensure that the proper crystal is inserted into the octal socket.

c. Set the SECOND LO MODE switch to the XTAL position.

d. Adjust the TUNING control to the desired frequency setting as observed through the dial window.

e. Set the VIDEO FILTER BANDWIDTH switch to the desired position. Set the VIDEO GAIN control to mid-range.

f. Set the AUDIO VOLUME control to the desired listening level.

Before operating the receiver, certain fundamental checks should be performed. These are the ones listed in paragraph 4-4, Section IV. No internal screwdriver adjustments should be necessary during normal operation of the receiver.

3.4 INTERNAL ADJUSTMENTS

The internal screwdriver adjustments are factory set and will not require adjustment during operation. When it becomes necessary to align the receiver, refer to the alignment procedures in Section V.

The 10 mc linear (before limiting) or non-linear (after limiting) output of the fm demodulator for application to the predetection down-converter may be selected by an operator performing the following:

a. Remove the top cover from the main chassis.

b. Disconnect the coaxial cable from the fm demodulator at A4-J3 or A4-J4.

c. Connect the coaxial cable to the desired output, A4-J3 for monitoring the 10 mc output before limiting or A4-J4 for monitoring the 10 mc output after limiting.

d. Replace the top cover on the main chassis.

SECTION IV
RANGE MAINTENANCE

4.1 INTRODUCTION

The Model TMR-18B Telemetry Receiver is designed to give troublefree performance in the field with a minimum of routine maintenance. High quality components, conservatively rated, are used in the fabrication of the receiver with emphasis placed on operation well within ratings. During normal operation, no periodic calibration or realignment should be necessary. Unnecessary adjustments may degrade the performance of the receiver and therefore should be avoided. For these reasons, preventive maintenance is limited to the checks as described in paragraph 4.2.

The preventive maintenance checks given should be performed at the recommended intervals to prevent malfunctions and needless interruptions while the receiver is in service. When performing these checks, if a malfunction is detected, refer to Section V for service instructions. Periodic visual inspections should be made of the unit for evidence of corrosion, loose connections, burned wiring insulation, and loose, burned, or charred component parts. For information regarding the placement of a component part, refer to paragraph 4.3.

A clean interior is necessary to ensure optimum performance by preventing corrosion and dirt from damaging parts or causing leakage between circuit points. Keeping the receiver relatively clean and dust-free, as well as in good mechanical condition is considered to be in keeping with good operating practices and is emphasized as a preventive maintenance procedure.

A primary requirement involving preventive maintenance of the receiver is the operator's thorough knowledge of the unit's operation and theory of operation, and preventive maintenance techniques.

The operator's understanding of any specified limitations and awareness of precautions applicable to the operation of the receiver will thus maximize reliable unit performance and prolong its service time.

Lubrication of the potentiometers is not required and should be avoided since damage to the controls could result. However, lubrication of the switch detents is recommended each time the semiannual checks are performed.

4.2 RECOMMENDED SCHEDULES

The recommended schedules consist of preventive maintenance checks to be performed in intervals of daily, weekly, monthly, quarterly, and semiannual periods.

4.2.1 DAILY
Visually inspect the exterior of the receiver for good physical condition of the meters, controls, indicators, and painted surfaces. Operate the controls; examine them for looseness and proper operation. Ensure that each control is positioned to the desired setting for the specific task to be accomplished.

If the receiver is rack mounted, check for the security of the receiver installation within the equipment rack. Before scheduled operation, check for the proper interconnection of the receiver to the monitoring equipment.

4.2.2 WEEKLY
Visually inspect the interior surfaces of the receiver for good physical condition and cleanliness.

Using a low pressure air hose, blow out accumulated dust from the inside of the chassis. Ensure that the air pressure is not great enough to damage parts or disturb wiring. After cleaning, make visual inspection of parts and wiring for corrosion, loose connections, frayed or burned insulation, loose screws, and burned or charred resistors. Carefully inspect all capacitors and sealed transformers for leakage of oil or filling compound. Check each subassembly for its proper security to the main chassis of the receiver.

4.2.3 MONTHLY
Visually inspect the main chassis and each subassembly for damage to component parts as follows:

a. Resistors for blistering, discoloration, and other evidence of overheating.

b. Switches or controls for unsatisfactory operation, corrosion, or loose contacts.

c. Wires for cracked, cut and/or frayed insulation.

d. Front panel controls for loose mounting.

e. Machine screws and nuts for mechanical looseness.

f. Input and output connectors for corrosion or looseness.

g. Finish for scratches and bare spots. Retouch the painted surfaces as required. (Refer to paragraph 4.2.4.)

h. Subassemblies for security to the main chassis.

4.2.4 QUARTERLY
Clean the exterior surfaces of the receiver ensuring that no harmful chemicals come in contact with the painted surfaces. Use a fine dust cloth to remove any dust or dirt from the meter facings. Use those cleaning aids listed in table 4-1 as applicable to accomplish the cleaning.

Touch-up the painted surfaces that have become chipped or scratched. Begin by thoroughly cleaning the affected surface; smooth the area with an abrasive paper; wipe clean; then paint. Refer to items in table 4-1 for applicable usage in the accomplishment of this task.

Table 4-1. Cleaning and Painting Materials

Item	Description	Supply Data	Application
1	Alcohol, ethyl, technical	FSN 6810-264-6616 (one gallon can)	General cleaning.
2	Brush, sash, oval	FSN 8020-597-5301 (1x5/8x2-1/8 in.)	Cleaning exterior surface and subassemblies.
3	Chamois, leather, sheepskin	FSN 8330-257-2494 (16 x 21 in.)	Dusting subassemblies, connectors, and part contacts.
4	Paper, abrasive, grit 400	FSN 5350-721-8118 (50 sheets)	Preparing damaged paint surfaces for touch-up.
5	Solvent, general purpose	FSN 6850-619-7715	Cleaning chassis, subassemblies, and panels.
6	Paint	Federal Standard 595, Color 16440	Touch-up painting of front panel finish.

4.2.5 SEMIANNUAL

The periodic operational checks, paragraph 4.4, and visual inspection of the receiver should be conducted semiannually as an overall check of the performance of the receiver and its physical condition, respectively.

4.3 ASSEMBLY AND DISASSEMBLY

The receiver is assembled and disassembled in a reasonable straightforward manner and should pose no difficulty to servicing personnel. Component part removal and replacement may be accomplished by using straightforward disassembly techniques for parts accessible from the top and bottom of the unit. Replacement is accomplished by using assembly techniques which are usually the reverse of disassembly.

In the event of component replacement, the receiver may require alignment. In general, it will be necessary to align only the circuit associated with the stage in which repairs were made. Always allow at least 20 minutes of warmup time before attempting any alignment procedures.

Care should be exercised when removing or replacing component parts not to damage or disturb other component parts mounted in close proximity to the specific part.

4.4 PERIODIC OPERATIONAL CHECKS

The periodic operational checks constitute the injection of the proper input signals to the receiver and the monitoring of the receiver outputs to determine the presence of desired signals. The receiver block diagram shown in figure 1-2 and the schematic diagram found in Section VIII will facilitate the analysis of the receiver's operation. If the performance is not satisfactory, the test instructions given in paragraph 5.1, Section V, should be used to locate and correct the malfunction. The performance of the receiver (and the initial alignment and adjustments required) may be checked using the procedures given in the following paragraphs. The periodic operational checks presented in the following paragraphs provide an indication of certain performance characteristics related directly to a subassembly within the receiver, to the plug-in rf tuning unit, and to the complete receiver.

4.4.1 IF GAIN ADJUST AND IF OUTPUT CHECK

Recommended Equipment:

Signal Generator	Boonton 202J
VTVM	HP 412A
RF Millivoltmeter	HP 411A

a. Connect the Boonton 202J to J1 on the receiver rear apron. Set the 202J for an output frequency of 235 mc at a 1 mv output level.

b. Tune in the signal.

c. Set the output level of the 202J to -100 dbm. Connect the HP 412A to TP1 on the demodulator. Set the AGC NORMAL/OFF switch to the OFF position. Observe that the vtvm indication can be reduced to less than 4 volts. Set the agc switch to the NORMAL position.

d. Set the output level of the 202J to 100 microvolts. Connect an HP 411A to J12. Note that the output at J12 is not less than 1 millivolt.

4.4.2 NOISE FIGURE CHECK

The most convenient method to measure noise figure of the rf tuning unit utilizes the output from the tuning unit at the interface between the tuning unit and the first i-f amplifier. The tuning unit gain is not adequate to reliably operate the noise figure meter so an auxiliary amplifier providing additional gain is used.

Recommended Equipment:

Noise Figure Meter	HP H18-340B
Noise Diode	HP 343A
Power Supply	HP 721A
Noise Figure Amplifier	DEI LM22503

a. Connect the 15-volt supply to C1 on the DEI LM22503 noise amplifier.

b. Connect the HP H18-340B to the HP 343A diode and connect the diode to J1, the rf input connector.

c. Disconnect A1P2 cable from the first i-f amplifier and connect it to J1 on the noise figure amplifier.

d. Connect a cable from J2 on the noise figure amplifier to the 30-mc input on the HP H18-340B.

e. Set the AGC switch to the OFF position. Tune frequency control on the tuning unit from 215 mc to 260 mc and observe the indication. The maximum allowable noise figure is 8 db when using the RTH-B18B and 11 db when using the RTH-F18B rf tuning units.

f. Set the AGC switch to the NORMAL position.

4.4.3 SIGNAL LEVEL METER CALIBRATION

This test checks the ability of the signal strength meter to read properly with each tuning unit. There are two adjustments (0 dbm and -100 dbm adjust) provided, accessible from the right side of the receiver, to set the high and low ends of the scale.

Recommended Equipment:

Signal Generator	Boonton 202J

a. Connect the Boonton 202J to J1, the rf input. Adjust the signal generator for an output level of 0 dbm at 235 mc.

b. Tune in the signal using the TUNING control and TUNING meter.

c. Set the signal level meter to indicate 0 dbm with R9, the 0 dbm ADJUST

d. Decrease the attenuator on the 202J to -100 dbm and adjust the signal level meter to indicate -100 dbm with R7, the -100 dbm ADJUST.

e. Repeat the above procedure until no further adjustment is required for proper indications at 0 dbm and -100 dbm.

4.4.4 VIDEO OUTPUT LEVELS

This test checks the output capability of both video amplifiers. Independent adjustments are provided on the dual video amplifier subassembly for each video output. These adjustments are readily accessible when the receiver top cover is removed. This test merely indicates that the video gain controls have their nominal settings.

Recommended Equipment:

FM Signal Generator	Boonton 202J
AC VTVM	HP 400D
Termination	75 ohms

a. Connect the 75-ohm termination to VIDEO OUTPUT A.

b. Connect an HP 400D across the 75-ohm termination.

c. Connect a Boonton 202J signal generator to the rf input, J1.

d. Set the signal generator to 235 mc at 1 millivolt rf output and adjust the modulation for 125 kc deviation at 1700 cps. Set the VIDEO GAIN control to maximum.

e. Tune in the signal using the TUNING control and the TUNING meter. If necessary, adjust R2 on the video amplifier for a 2.5v rms indication on the HP 400D.

f. Connect the HP 400D and 75-ohm termination to VIDEO OUTPUT B. If necessary, adjust R1 on the video amplifier for 2.5v rms.

4.4.5 PREDETECTION DOWN-CONVERTER OUTPUT LEVEL

This test checks the video output capability of the predetection down-converter.

An adjustment is provided on the predetection down-converter subassembly to set the video carrier output level. This adjustment is accessible from the top of the receiver when the top cover is removed.

The output level of the 10-mc output before limiting and the 10 mc output after limiting and the gain of the predetection down-converter are such that approximately 6 db excess gain is provided. Output capability of the down-converter is such that approximately 10 volts peak-to-peak can be developed across a 91-ohm load before clipping occurs. This test merely indicates that the video carrier output level is nominally correct when the predetection down-converter is connected to the 10-mc i-f output before limiting.

Recommended Equipment:

FM Signal Generator	Boonton 202J
AC VTVM	HP 400D
Termination	91 ohms

a. Connect the 91-ohm termination to the VIDEO CARRIER OUTPUT, J5, and connect an HP 400D across the 91 ohm termination.

b. Connect a Boonton 202J signal generator to the rf input, J1.

c. Set the signal generator to 235 mc at 1 millivolt rf output, and adjust the modulation for 125 kc deviation at 1700 cps.

d. Tune in the signal using the TUNING control and TUNING meter.

e. If necessary, adjust R12 for an HP 411A indication of 2.3v rms.

4.4.6 2ND LO VERNIER TUNING RANGE

This test checks the range of the vfo second local oscillator and the output frequency of the crystal-controlled second local oscillator.

Recommended Equipment:

Signal Generator	HP 606A
RF Millivoltmeter	HP 411A
Electronic Counter	HP 5245L

a. Connect the HP 606A, set to exactly 30 mc, to J1 on the i-f amplifier subassembly. Connect the HP 5245L counter to J3 on the i-f amplifier. Set the output level of the HP 606A to 5 mv. Set the SECOND LO MODE switch to the VFO position.

b. Set the VERNIER TUNING KC control to the center of its range. The counter should indicate a frequency of 10.000 mc. Adjust C46, if necessary, to obtain the 10-mc output frequency.

c. Set the VERNIER TUNING KC control fully counterclockwise and note that the counter indicates a frequency of not less than 10.250 mc.

d. Set the VERNIER TUNING KC control fully clockwise and note the counter indicates a frequency of not greater than 9.750 mc. Set the VERNIER TUNING KC control to midrange.

e. Set the SECOND LO MODE switch to the XTAL position. The counter should indicate a frequency of 10 mc ±3 kc.

4.4.7 AGC RECORD OUTPUT CALIBRATION

This test checks the limits of the AGC RECORD OUTPUT when the input signal to the receiver is varied over its dynamic range.

Recommended Equipment:

Signal Generator	Boonton 202J
DC VTVM	HP 412A
Termination	240 ohms

a. Connect a 240-ohm termination to the AGC RECORD OUTPUT, J6, and connect an HP 412A across the 240-ohm termination.

b. Connect the Boonton 202J signal generator to the rf input, J1. Set the signal generator to 235 mc at an output level of -70 dbm.

c. Tune in the signal using the TUNING control and TUNING meter.

d. Set the signal generator to an output level of 0.1 microvolt. Adjust the AGC RECORD ADJ, R10, for a -5 volt indication on the HP 412A.

e. Increase the signal generator output to 0 dbm and observe the meter indication to be +5v ±10%. It may be necessary to adjust R13 on the agc amplifier to obtain the +5 volt level.

4.4.8 METERING PERFORMANCE

This test checks the proper operation of the deviation and OUTPUT meters.

Recommended Equipment:

FM Signal Generator	Boonton 202J
Termination	75 ohms

a. Connect a 75-ohm termination to VIDEO OUTPUT A.

b. Connect a Boonton 202J signal generator to the RF INPUT, J1.

c. Set the signal generator to 235 mc and an output level of 1 millivolt with 125 kc deviation at 1700 cps.

d. Tune in the signal using the TUNING control and the TUNING meter. Observe that the deviation meter indicates approximately half scale. Observe that the OUTPUT meter can be set to 0 dbm (upper scale) with the OUTPUT METER CALIBRATE control.

SECTION V
BASE MAINTENANCE

5.1 MAJOR OVERHAUL

The Model TMR-18B Telemetry Receiver has been carefully designed to give long and troublefree operation. Therefore, should repair become necessary, the corrective maintenance procedures presented in this section should be performed to eliminate the cause of the malfunction and to restore the unit to its original operating condition. For the reasons mentioned previously, it is probable that the need for internal repair will arise only very infrequently.

No specific overhaul procedures are required for this unit. However, each time the unit is serviced a visual inspection should be made of the unit's interior. A clean interior is necessary to ensure optimum performance by preventing corrosion and dirt from damaging parts or causing arc-over or leakage between circuit points. Blow out dust from the inside of the chassis. Be careful that air pressure is not great enough to damage parts or disturb wiring.

After cleaning, make visual inspection of parts and wiring for corrosion, loose connections, frayed and burned insulation, loose screws, and burned or charred resistors. Carefully inspect connectors for broken contacts, and capacitors for leakage of oil or filling compound.

Lubrication of the potentiometers or controls is not required and should be avoided since damage to the components could result.

Troubleshooting techniques should be based upon the performance of the equipment and upon a thorough knowledge of the principles of operation as contained in Section II of this instruction manual. The use of the schematic diagrams in Section VIII should facilitate servicing.

Frequently, visual inspection provides a clue to the source of the trouble by enabling location of damaged components, for an example, burned or discolored resistors or chokes, overheating or leaky capacitors.

5.2 SPECIAL COMPONENT FABRICATION AND REPAIR

The receiver has been designed so that repairs may be made conveniently to its component parts. Repairs may be accomplished by using straightforward assembly and disassembly techniques. No specific component fabrication is required to make the necessary repairs.

5.3 PERFORMANCE REQUIREMENTS

The performance requirements for normal operation of the receiver are listed in table 1-1. Should performance of the unit deteriorate beyond the requirements specified in table 1-1, realignment may be necessary. To accomplish the realignment of the unit, refer to paragraph 5.6 for complete aligment procedures.

5.4 SPECIAL CORRECTIVE MAINTENANCE REQUIREMENTS

No special corrective maintenance requirement is applicable for the receiver. The information presented in the preceding and following paragraphs may be utilized to restore the unit to its full operating capabilities.

5.5 RECOMMENDED TEST EQUIPMENT AND TEST FIXTURES

The test equipment and test fixtures listed in this paragraph are the recommended equipment to be used for performing the maintenance or alignment procedures of the receiver.

a.

Recommended Equipment	Manufacturer and Model Number
Signal Generator	Hewlett-Packard 606A
Signal Generator	Hewlett-Packard 608D
Signal Generator	Hewlett-Packard 651A
FM Signal Generator	Boonton 202J
Univerter	Boonton 207G
Sweep Generator	RCA WR-59C
Oscilloscope	Hewlett-Packard 130C
Distortion Analyzer	Hewlett-Packard 330B
Wide Range Oscillator	Hewlett-Packard 200CD
Electronic Counter	Hewlett-Packard 5245L
RF Millivoltmeter	Hewlett-Packard 411A
RF Probe Kit	Hewlett-Packard 11027A
AC VTVM	Hewlett-Packard 400D
VTVM	RCA WV-98 (A, B, or C)
1% VTVM	Hewlett-Packard 412A
Standing Wave Indicator	Hewlett-Packard 415B
Power Supply	Hewlett-Packard 721A
Attenuator	Jerrold AV-50
Adaptor (2) BNC/Microdot	Microdot 033-0203
Adaptor (2) BNC/Microdot	Microdot 033-0204
Power Splitter (3 db)	Microlab DA-3FN

b. Test Fixtures	Model Number
Test Cable, Module	B32444
Test Cable, RF Tuning Unit	B32253
Test Cable, First IF Amplifier	B32445
Test Fixture	D32287
Test Fixture, RF Tuning Unit, Bottom Cover	C32285
Test Fixture, RF Tuning Unit, IF Plate	C32286
Test Fixture, IF Filter	B32252
Alignment Fixture 50 ohms	C17247
Alignment Fixture, 91 ohms	C17248
50 ohm Detector	C17208
Cable Assembly, Test Fixture (2)	B32489

5.5.1 INITIAL TEST SETUP

All subassemblies are to be installed in the receiver unless otherwise noted in the detailed procedures. Interconnecting cables within the receiver are somewhat longer than normal to simplify field maintenance and servicing. Care must be taken to avoid short circuiting power supplies and other circuitry when the interconnecting cables are disconnected.

Before applying power to the receiver, preset the controls and adjustments as follows:

Location	Control	Setting
Front Panel	FIRST LO MODE	XTAL
	TUNING	235 MC
	SECOND LO MODE	XTAL
	SECOND LO VERNIER TUNING KC	Center Zero
	AUDIO VOLUME	Midrange
	OUTPUT METER CALIBRATE	Midrange
	POWER	Off
Rear Apron	AGC	Normal
	AGC RECORD ADJ	Midrange
Internal	IF GAIN ADJ, R11	Midrange
	-100 DBM ADJUST, R7	Midrange
	0 DBM ADJUST, R9	Midrange
AGC Amplifier Subassembly	All Potentiometers	Midrange
Dual Video Amplifier Subassembly	R9 and R3	Midrange

5.6 ALIGNMENT PROCEDURES

The receiver top and bottom covers must be removed prior to alignment. Refer to paragraph 5.5 for the recommended equipment and initial control settings.

5.6.1 POWER SUPPLY ADJUSTMENTS AND CHECKS

a. Apply power to the receiver. Connect an HP 412 vtvm between the emitter of Q2 and ground. Adjust A9R13 (power supply regulator) for -15 vdc.

b. Disconnect the HP 412A from the emitter of Q2. Set the HP 412A for positive voltage measurements.

c. Connect the HP 412A between the emitter of Q1 and ground. Adjust A9R10 for +15 vdc. Disconnect the HP 412A.

d. Connect the HP 412A, set to the +300 volt range, to pin B of C1 and note a voltage level of +150 vdc.

e. Disconnect the HP 412A from C1 and connect it to CR1, located on the rear apron, and note a voltage level of +100 vdc.

f. Connect the HP 412A to the positive connection of C2 and note a voltage level of +23.5 vdc.

g. Connect the HP 412A to the negative connection of C3 and note a voltage level of -23.5 vdc.

5.6.2 DUAL VIDEO AMPLIFIER

a. Remove the video amplifier input cable, W7, from J5 at the demodulator. Set the VIDEO BANDWIDTH switch to the DIRECT position.

b. Connect the HP 412A to the VIDEO OUTPUT A connector on the rear apron. Adjust R9 for a vtvm indication of 0 (±0.2) vdc.

c. Connect the HP 412A to the VIDEO OUTPUT B connector. Adjust R3 for a vtvm indication of 0 (±0.2) vdc.

d. Connect a 75-ohm termination to VIDEO OUTPUT A. Connect an HP 400D vtvm to this termination.

e. Connect the 50-ohm output of the HP 651A signal generator to the video amplifier input (W7) using a type 033-0203 BNC-to-Microdot adaptor and a length (less than 3 feet) of RG-62A/U cable.

f. Set R2 fully clockwise. Set the VIDEO GAIN control to maximum. Set the HP 651A for an output frequency of 10 kc with an output level that produces a 2.0v rms indication on the HP 400D. Note the voltage level indicated by the output meter of the HP 651A, it should be between 0.25 and 0.45v rms.

NOTE

The HP 651A output meter is designed to read the rms voltage across a 50-ohm load connect to the output terminals. Output impedance of the HP 651A is 50 ohms. The input impedance of the video amplifier is not 50 ohms. Therefore, the voltage applied is different than the value indicated on the output meter of the HP 651A. This is taken into account in the test limits.

g. Set the HP 651A to the 1.0 volt range and adjust its output level for an output meter indication of 0 db at 10 kc.

h. Adjust the VIDEO GAIN control for a 0 db indication on the 3 volt range of the HP 400D.

i. Set the HP 651A for an output frequency of 1.0 mc while maintaining the 0 db indication on the output meter.

j. Note the indication of the HP 400D; it should be no greater than 2.5 db below the 0 db reference set in step h.

k. Transfer the 75-ohm termination and the HP 400D to the VIDEO OUTPUT B connector. Set R1 fully clockwise. Set the VIDEO GAIN control to maximum.

l. Set the HP 651A for an output frequency of 10 kc with an output level that produces a 2.0 volt indication on the HP 400D. Note the voltage level indication by the output meter of the HP 651A; it should be between 0.25 and 0.45v rms.

m. Set the HP 651A to the 1 volt range and adjust its output for an output meter indication of 0 db at 10 kc.

n. Adjust the VIDEO GAIN control for a 0 db indication on the 3 volt range of the HP 400D.

o. Set the HP 651A for an output frequency of 1.0 mc at a level 0.19v rms as indicated by the output meter.

p. Note the indication of the HP 400D; it should be no greater than 2.5 db below the 0 db reference set in step n.

q. Set the HP 651A for an output frequency of 10 kc at a level of 0 db on the 1 volt range of the output meter.

r. Set the VIDEO FILTER BANDWIDTH control to the DIRECT position. Set the VIDEO GAIN control to produce a 0 db indication on the 3 volt range of the HP 400D.

s. Set the VIDEO FILTER BANDWIDTH switch to the 250 kc position. Adjust the HP 651A to produce a -3 db indication on the HP 400D. The frequency of the HP 651A should be 250 kc ±10%.

t. Repeat steps q, r, and s for each setting of the VIDEO FILTER BANDWIDTH switch. The frequencies required to produce a -3 db indication on the HP 400D should be within ±10% of frequency indicated at each switch position.

u. Disconnect all test equipment and reconnect W7 to J5.

5.6.3 PREDETECTION DOWN-CONVERTER

a. Disconnect the input cable to the converter at J3 or J4 on the demodulator.

b. Connect an HP 412A to the junction of R41 and C24. Adjust R30, available through a hole in the rear apron of the receiver, for a +0.2 vdc indication on the vtvm.

c. Connect an HP 606A signal generator to the input cable using a type 033-0264 BNC-to-Microdot adaptor and a suitable length of RG-223/U or RG-55A/U cable.

d. Connect a 91-ohm termination to the VIDEO CARRIER OUTPUT on the rear apron of the receiver. Connect an HP 400D to the 91-ohm termination using a suitable length of RG-62/U cable (less than 3 feet).

e. Set R12, on the converter, to the clockwise stop. Set the HP 606A to 10 mc using the internal calibrator. Adjust the output level of the HP 606A to produce a 0 db indication on the 3 volt range of the HP 400D. The output level required to produce the 0 db indication should be between 35 and 60 mv.

f. Decrease the output level of the HP 606A by 10 db. Set the HP 400D to the 1 volt range and note an indication of approximately 0 db.

g. Set the HP 606A for an output frequency of 10.0 mc with an output level that produces a 0 db indication on the 3 volt range of the HP 400D.

h. Vary the frequency of the HP 606A from 10.0 mc to 10.3 mc and from 10.0 mc to 9.7 mc. Note that the level indicated by the HP 400D is consistent within ±1 db.

i. Remove the test equipment, including the 91-ohm termination, and connect the converter input to J3 on the demodulator.

5.6.4 FM DEMODULATOR

a. Remove the agc amplifier from the receiver main chassis.

b. Connect the HP 606A to the input cable of the demodulator using a type 033-0204 BNC-to-Microdot adaptor using a suitable length of RG-223/U or RG-55A/U cable.

c. Set the HP 606A for an output frequency of 10 mc, using the internal calibrator, with an output level of 100 mv.

d. Connect the HP 411A rf millivoltmeter, set to the 0.1 volt range and terminated in 50 ohms, to J3 of the demodulator using the DEI B32489 test cable and a type 033-0203 BNC-to-Microdot adaptor.

e. Adjust T1 for a maximum indication on the HP 411A.

f. Adjust the output level of the HP 606A to produce a 0 db indication on the 0.1 volt range of the HP 411A. Vary the output frequency ±300 kc and note that the output level varies less than 0.5 db.

NOTE

T1 can be readjusted, if necessary, to equalize the HP 411A indications at ±300 kc.

g. Transfer the HP 411A to J4. Set the output of the HP 606A to 10.0 mc at 3 mv.

h. Adjust L1 and T2 for a maximum indication on the HP 411A.

i. Increase the output level of the HP 606A to 200 mv. Vary the output frequency ±300 kc and note that the HP 411A indication does not change more than 0.5 db.

NOTE

T2 can be readjusted, if necessary, to equalize the ±300 kc vtvm indications.

j. Connect the HP 412A vtvm to TP1. Set the HP 606A for an output frequency of 10.0 mc with an output level that produces a +4.5 vdc indication in the vtvm. The output level required to produce a +4.5 volt indication on the vtvm should be between 170 and 230 mv.

k. Connect the HP 411A to J3 and note a voltage level of between 70 and 110 mv. Connect the HP 411A to J4 and note a voltage level of between 70 and 110 mv.

l. Decrease the output level of the HP 606A by 30 db and note that the output level at J4 decreases by less than 10%. Remove the HP 411A and HP 412A.

m. Set the slugs of Z1 and Z2 to the counterclockwise stop. Set the HP 412A to the -0.1 volt range and connect it to the negative terminal of the tuning meter.

n. Set the HP 606A to 10.0 mc, using the internal calibrator, with an output level of 200 mv.

o. Adjust the slug in Z1 for a maximum indication on the HP 412A. Adjust the slug in Z2 for the first zero indication on the tuning meter.

NOTE

The indication on the HP 412A may increase before it decreases and goes through zero.

p. Remove the HP 412A. Connect the Boonton 202J signal generator output to the Boonton 207G univerter input. Set the univerter dial to zero. Transfer the cable from the HP 606A output to the univerter output.

q. Set the output of the 202J signal generator to 0 dbm and frequency which produces a 10-mc output from the univerter. The correct setting of the signal generator will produce a 0 indication on the tuning meter.

r. Connect an HP 400D to J5, on the demodulator, using a type 033-0204 BNC-to-Microdot adaptor and a suitable length of RG-62/U cable.

s. Connect an HP 200CD wide range oscillator to the external fm modulation terminals on the 202J. Using the external modulation, adjust the 202J for 150 kc of deviation at a 1 kc rate. Ensure the receiver tuning meter reads zero.

t. Adjust C16 for a 1.9v rms indication on the HP 400D. Transfer the cable from univerter to the HP 606A. Set the output of the HP 606A to exactly

10 mc and adjust Z2 for a zero indication on the tuning meter. Transfer the cable back to the univerter.

u. Reduce the deviation from 150 kc to 10 kc. Reset the 202J, if necessary.

v. Connect the HP 415B standing wave meter, set to the 200k input on the 30 db range and on the expanded scale, to J5.

w. Adjust the HP 415B gain control for a 0.5 db indication on the expanded scale with a 10-mc input.

x. Vary the univerter from zero to plus 200 kc and from 0 to minus 200 kc and note the maximum increase and decrease in reading for each side of zero as indicated on the HP 415B. If the HP 415B meter reading is within ±1 division (0.2 db) over ±200 kc no further adjustment is needed. If adjustment is indicated, the actual adjustment to be done depends upon the variation in the HP 415B reading over ±200 kc.

y. A perfect adjustment for the discriminator yields a slope plot (HP 415B reading) which increases by approximately 1 small division (0.2 db) as frequency is changed on either side of 10 mc with the peaks occurring at approximately ±200 kc.

z. The discriminator response (S curve) is slightly different from that of an inductively coupled Foster-Seeley discriminator. The configuration used produces a discontinuity in the S curve at approximately ±300 kc from center frequency. A slight adjustment of Z1 (primary) acts to linearize the curve in the area of interest. A slight adjustment of Z1 will usually be required.

aa. If the HP 415B reading decreases with increasing frequency and increases with decreasing frequency or vice versa, an incremental adjustment of Z1 is needed. Tilt of the slope plot indicates a continuously changing slope. Make an incremental adjustment of Z1 noting the direction of slug rotation, and vary input frequency ±200 kc noting the HP 415B indication. A nearly constant reading indicates an adjustment in the right direction. Two or three adjustments should be all that are required to obtain an essentially flat slope plot. Ensure that 10 mc is being applied (zero on tuning meter) when the univerter dial reads zero.

bb. If the slope plot (after adjustment of Z1) shows peaks which exceed 1 small division but otherwise appears satisfactory (essentially flat) there is too much coupling. Likewise, if the slope plot looks round (falls off both sides of 10 mc) there is too little coupling.

cc. Coupling is controlled by C16. If less coupling is required, proceed as follows: Connect J5 output to the HP 400D. Increase the deviation to

150 kc making sure that the tuning meter reads zero. Note the reading on the HP 400D. Adjust C16 to increase the HP 400D reading by approximately 5%. Connect the HP 606A to the demodulator input in place of the univerter. Set the HP 606A to 10.0 mc and adjust Z2 for zero on the tuning meter. Reconnect the univerter and HP 415B. Decrease the deviation to 10 kc and recheck the slope plot. Z1 may again require an incremental adjustment.

dd. Connect the HP 400D to the VIDEO OUTPUT. Increase the deviation to 125 kc. Note the indication on the HP 400D; it should be between 1.35 and 1.75v rms.

ee. Remove the HP 400D from J5 and reconnect W7 to J5. Adjust R37 for a deviation meter indication of 125 kc with 125 kc deviation applied. R37 is located on the video filter board and adjustable from the bottom of the receiver.

ff. Connect the HP 606A to the demodulator input. Set the HP 606A to 10 mc. Connect a 10k resistor to J15. Connect the HP 412A across the resistor.

gg. Vary the frequency of the HP 606A from 10.4 mc to 9.6 mc and note that the HP 412A indicates a voltage level greater than ±2.0 vdc.

hh. Disconnect all test equipment and install the top cover on the demodulator. Reconnect the cable between the demodulator and the second i-f amplifier. Do not install the agc amplifier.

5.6.5 AUDIO AMPLIFIER

a. Set the AUDIO GAIN control fully counterclockwise. Connect the HP 412A to pin 2 of XA8. Note that the dc voltage is less than ±0.5 volts. If this voltage is greater than ±0.5 vdc but less than ±1 vdc,proceed with steps b and c. If the voltage measured is greater than ±1 vdc, proceed with step d.

b. Using the Boonton 202J and the 207G combination, connect the 207G output to P1 on the demodulator using the 033-0203 adaptor and RG-223/U or RG-55A/U cable. Set the output level of the 202J to 200 mv and a frequency which produces a 10-mc output from the 207G. Adjust the 202J for 125 kc of deviation at a 1 kc rate.

c. Connect the HP 130C oscilloscope to pin 2 of XA8. Adjust the AUDIO GAIN control to produce at least 6 volts peak-to-peak oscilloscope deflection. There should be no clipping or distortion present on the waveform. A satisfactory oscilloscope display indicates an acceptable amplifier.

d. If the DC voltage across the speaker is greater than ±1.0 volts, it will be necessary to change R12 to another value in order to obtain adequate DC balance in the amplifier. If the DC voltage is greater than minus 1 volt it indicates that Q2 is drawing too much current. Consequently the value of R12 will have to be increased. If R12 is changed the test given in steps b and c should be made.

5.6.6 SECOND IF AMPLIFIER

For purposes of clarity the second i-f amplifier will be aligned in two sections; the bandpass filter and the 10 mc amplifier. Insure that the agc amplifier is removed from the receiver for both alignments.

5.6.6.1 500 KC BANDPASS FILTER

a. Since the filter is a passive unit, operating voltages are not required.

b. Carefully disconnect the A3L1 centertap connection from the standoff terminal. Avoid disturbing the torroid A3L1. Mount the BNC output test fixture, DEI B32252, on the filter box and solder the center pin to the disconnected torroid (A3L1) centertap connection.

c. Connect the HP 411A-21D Type N Tee connector to the BNC output connector on the test fixture. Terminate the tee connector in 50-ohms.

d. Connect the filter input (P1 and A3W1) to the HP 606A using the test cable DEI B32489 and a type 033-0203 adaptor.

e. Set the HP 606A for an output frequency of 9.988 mc with a level of 100 mv using the HP 5245L electronic counter.

f. Using the clip-on probe, connect the HP 411A to the centertap of L7 at the tiepost. With a short cliplead (1-1/2 inches or less) ground the junction of L6-C19 to the chassis.

g. Adjust Z1 for a peak indication on the HP 411A, changing scale as necessary to maintain a useable indication. DO NOT CHANGE SIGNAL GENERATOR OUTPUT LEVEL.

h. Transfer the cliplead to the junction of L5-C15. Adjust Z2 for a minimum indication on the HP 411A, changing the scale as necessary to maintain a useable reading.

i. Transfer the cliplead to the junction of L4-C12. Adjust Z3 for a maximum indication on the HP 411A.

j. Transfer the cliplead to the junction of L3-C8. Adjust Z4 for a minimum indication on the HP 411A.

k. Transfer the cliplead to the junction of L2-C4. Adjust Z5 for a maximum indication on the HP 411A.

l. Transfer the cliplead to the junction of L1-C2. Adjust Z6 for a minimum indication on the HP 411A.

m. Remove the cliplead from the junction of L1-C2. Adjust Z7 for a maximum indication on the HP 411A. This peak is very broad and care should be exercised to assure that the adjustment is in the center of the peak.

n. Disconnect the HP 411A from the centertap of L7. Remove the probe tip and connect it to the Tee Adaptor at the output BNC test fixture on the fixture.

o. Set the HP 606A to 10 mc with an output of approximately 100 millivolts. Set the range of the HP 411A and the HP 606A output level so as to obtain a convenient level on the HP 411A. Note this reading as a reference.

p. Vary the 606A frequency above and below 10 mc and note the frequencies at which the output of the filter falls to 3 db below the 10 mc output reference (use counter to accurately measure these frequencies).

NOTE

The frequency difference between the 3 db points should be 500 kc ±25 kc, and should be symmetrically situated about 10 mc within 5%.

q. If the 3 db symmetry varies more than 5%, repeat the alignment procedure more carefully.

r. If the 3 db bandwidth still varies more than 5%, choose a different value for C15. If a change of one value in C15 does not produce the desired results, C12 and/or C19 may also be changed. If the center of the response is off-set from 10 mc by more than 12.5 kc, set the HP 606A for an output frequency of 9.988 mc plus one-half of the difference between the measured center frequency and 10 mc and repeat the alignment procedure.

s. Connect the HP 411A, with the terminated tee connector, to the rf output connector on the HP 606A. Set the frequency of the HP 606A to 10 mc with an output level that produces a zero db indication on the -10 db range of the HP 411A.

t. Disconnect the Tee adaptor from the HP 606A and connect it to the output BNC test fixture. Note this level as a reference.

u. Connect the HP 606A to the filter input (P1) and again observe the reading on the HP 411A.

v. Subtract the level obtained in step u from that obtained in step t. The difference should be 4 (±1) db.

w. Disconnect the HP 411A and HP 606A.

5.6.6.2 10 MC AMPLIFIER

a. Remove the top cover from the subassembly. Remove the screws from the mountings but do not remove the bottom cover. Remove the top cover from the filter assembly.

b. Install the DEI B32252 test fixture to the filter by tack soldering it to the amplifier input at the tiepost.

c. Unsolder the tap of L1 at the tiepost if it is connected.

d. Connect the HP 411A, with the terminated tee connector, to J1 of the amplifier using the DEI B32489 test cable and a type 033-0204 adaptor. Set the HP 411A to the 0.3 volt range.

e. Connect the HP 606A to the alignment fixture installed at the amplifier input. Connect an HP 721A power supply to the junction of R36 and pin 1 of J2.

f. Set the HP 721A to supply -1.5 vdc. Apply power to the amplifier subassembly.

g. Set the HP 606A for an output frequency of 10 mc with an output level that produces a zero db indication on the HP 411A.

h. Adjust T6 for maximum inductance. This occurs when the slug starts out of the bottom of the transformer. This is not a critical adjustment.

i. Tune T5 for a maximum indication on the HP 411A.

j. Set the HP 606 for an output of 12.2 mc. Adjust T1 and T3 for a maximum indication on the HP 411A.

k. Set the HP 606A for an output of 7.8 mc. Adjust T2 and T4 for a maximum indication on the HP 411A.

l. Set the HP 606A to 10 mc with an output level that produces a zero db indication on the HP 411A. Replace the HP 411A with the DEI C17208 10/30 mc detector. Connect the detector output to the vertical input of the oscilloscope using RG 62/U cable.

m. Set the oscilloscope for dc operation. Connect the horizontal output of a WR-59C sweep generator to the horizontal input of the oscilloscope. Connect the sweep output of the WR-59C to the amplifier input in place of the HP 606A.

n. Set the sweep generator output and sweep width for full scale deflection.

o. Connect the HP 606A, set to 10 mc, across the filter box using the DEI C17247 50-ohm alignment fixture. Adjust the output level of the HP 606A to produce a marker on the oscilloscope display.

p. Adjust T5 to produce the flattest overall response near 10 mc. Observe that the response is approximately ±1.8 mc at about the 90% response points and that the variation in response, across the band, is not greater than 10%. The response should be within 5% of that at center frequency over ±300 kc.

q. Replace the sweep generator and detector with the HP 606A and HP 411A.

r. Remove the bias connection. Set the HP 606A to 10.0 mc and adjust its output for a 0 db indication on the 0.3 volt range of the HP 411A. The amplifier gain is the difference between output (0 dbm) and input as read on the HP 606A attenuator and meter. The gain should be between 55 and 61 db.

s. This concludes the amplifier alignment. Remove the alignment fixture. Solder the tap on L1 to the tie point. Replace the top cover on the amplifier and the filter. Do not mount the 2nd i-f subassembly if the 1st i-f subassembly is to be aligned next.

5.6.7 FIRST IF AMPLIFIER

a. Ensure that the agc amplifier is removed from the receiver.

b. Set the SECOND LO MODE switch to the VFO position. Set the HP 411A to the three volt range and connect it (using the probe tip) to the junction of CR5 and R27. Adjust L5 and T7 for a maximum reading on the HP 411A.

c. Connect an HP 5245L counter to the junction of CR5 and R27 using less than four feet of RG 62/U cable and open clipleads. Adjust C46 to center the range of the VERNIER TUNING KC control around 40 mc. Observe that the VERNIER TUNING KC control is capable of adjusting frequency at least ±260 kc around 40 mc.

d. Set the SECOND LO MODE switch to the XTAL position. Set the HP 411A to the 3 volt range and connect it (using the probe tip) to the junction of

CR5 and R27. Adjust L7 for a maximum reading on the HP 411A.

e. Disconnect the HP 411A and connect the HP 5245L counter to the junction of CR5 and R27; the frequency indicated should be 40.00 mc ±3 kc.

NOTE

Final adjustment of the 2nd LO frequency is made after the cover is installed on the 1st IF subassembly since the cover effects the LO frequency slightly.

f. Set the SECOND LO MODE switch to the VFO position. With the 1-o frequency set to 40 mc connect the HP 411A to the junction of CR5 and R27. Adjust L5 and T7 for a maximum reading on the HP 411A. The maximum level should be between 1.6 and 2.0 volts.

g. Place the SECOND LO MODE switch to the XTAL position and note that the HP 411A indicates a level between 1.6 and 2.0 volts.

h. Connect the HP 411A, with the terminated tee connector, to J3 using the DEI B32489 test cable and a type 033-0204 adaptor. Connect the HP 606A to J1 using the DEI B32489 test cable, a type 033-0203 adaptor, and a suitable length of RG 62/U cable. Ensure that the VERNIER TUNING KC control is set to 40 mc ±2 kc.

i. Set the HP 606A to 30.0 mc (using its calibrator) at an output level that produces an indication of approximately 0 db on the 0.03 volt range of the HP 411A.

j. Adjust the slugs of T1 and T8 to the center of their range.

k. Adjust T4 for a maximum indication on the HP 411A, adjusting the output of the HP 606A as required to maintain an indication of approximately 0 db on the HP 411A.

l. Set the HP 606A to 32.8 mc and adjust T2 for a maximum indication on the HP 411A.

m. Set the HP 606A to 27.2 mc and adjust T3 for a maximum indication on the HP 411A.

n. Set the HP 606A to 30.0 mc and adjust its output for a zero db indication on the HP 411A. Vary the input frequency from 29 mc to 31 mc and observe the indication on the HP 411A. Adjust T4, if required, to equalize the response from 29 to 31 mc.

The response from 29.5 to 30.5 mc must be constant within 0.5 db.

o. Set the HP 606A to 30 mc and adjust its output for a zero db reading on the HP 411A (-20 dbm). The gain is the difference between -20 dbm and the indication on the HP 606A. The difference should be between 26 and 31 db.

p. Install the top cover for the first i-f subassembly and tighten all screws.

q. Connect an HP 5245L counter in place of the HP 411A. Set the output from the HP 606A to 5 millivolts and adjust its frequency to 30.0 mc (using the internal calibrator).

r. Adjust C46 to center the range of the VERNIER TUNING KC control about 40 mc. It is important that the HP 606A be set accurately to 30 mc since the counter is reading the difference between the second local oscillator and the 30 mc input.

s. Set the VERNIER TUNING KC control for a counted frequency of 10 mc ±2 kc. Loosen the set screws on the knob and set the knob pointer to the index line. Retighten the set screws. If center frequency is correct within ±10 kc and the end points are within 25 kc of each other adjustment is adequate. The vernier tuning range must exceed ±250 kc around a center frequency of 40 mc. Set the VERNIER TUNING KC control maximum counterclockwise and note that the counter indicates a minimum frequency of 10.250 mc. Set the control maximum clockwise and note that the counted frequency is not greater than 9.750 mc.

t. This concludes the test for the first i-f subassembly. Disconnect the HP 606A and counter. Mount the second i-f amplifier subassembly and reconnect the internal cables.

5.6.8 AGC AMPLIFIER

a. Install the agc amplifier subassembly into the receiver.

b. Connect an HP 606A to the input cable of the demodulator (A4P1) using a type 033-0204 adaptor and a suitable length of RG-223/U (or RG-55A/U) cable. Connect an HP 412A, set to the ±10 volt range, to the agc detector test point, TP1, on the demodulator. Set the HP 606A to 10.0 mc and adjust its output for a 3.5 volt indication on the HP 412A.

c. Connect the HP 412A to pin 4 of XA6. Adjust A6R2 for a zero ±0.2 volt indication on the HP 412A. This indication will not necessarily be repeatable at a later time.

d. Set the HP 412A to the -10 volt scale. Set the HP 606A output to 50 millivolts at a frequency of 30.0 mc. Adjust the VERNIER TUNING KC control for a zero reading on the tuning meter.

e. Adjust A6R10 for an indication of -8 volts on the HP 412A.

f. Connect a 240 ohm ±5% 1/2 watt resistor to AGC RECORD OUTPUT (J6) on the rear apron. Reduce the output of the HP 606A to obtain a 1.5 volt indication on the -3 volt range of the HP 412A connected to pin 4 of XA6.

g. Connect the HP 412A to pin 11 of XA6 and adjust the AGC Record ADJ control (R10), located on the rear apron of the receiver, for a zero volt indication on the 3 volt range of the HP 412A.

h. Connect the HP 412A, set to the -10 volt range, across the 240 ohm resistor. Adjust A6R26 for a vtvm indication of 5 volts.

i. Increase the output of the HP 606A to 50 millivolts. Switch the HP 412A to the ±10 volt range. Adjust A6R13 for a meter indication of +5 volts.

NOTE

If the preliminary adjustment of R26 and R13 is made without the 240 ohm load connected, it is probably that the final adjustments (made in a subsequent step) cannot be made.

j. This concludes the set-up of the agc amplifier subassembly.

5.6.9 OVERALL RECEIVER

a. Install a previously tested RTH-B18B tuning unit into the receiver.

b. Connect a Boonton 202J to the rf input (J1). Set the 202J for an output of 1 millivolt at a frequency of 235 mc (approximately). Tune in the signal. Set the 202J for a deviation of 125 kc at a 1 kc (or 1.7 kc) rate.

c. Connect a 75 ohm termination to VIDEO OUTPUT A. Connect an HP 400D to the termination. Set the VIDEO GAIN control for maximum. Adjust R2 on the video amplifier subassembly for an indication of 2.5 volts rms on the HP 400D.

d. Observe that the output meter on the receiver reads below 0 db (approximately -4 db) with the OUTPUT CALIBRATE control maximum CCW and

that this control can adjust the output meter to zero db.

e. Transfer the 75 ohm termination and HP 400D to VIDEO OUTPUT B. Adjust R1 on the video amplifier subassembly for an indication of 2.5 volts rms on the HP 400D.

f. Connect a 91 ohm termination and the HP 400D to the VIDEO CARRIER OUTPUT (J5). Connect the down converter input to J3 on the demodulator subassembly.

g. Adjust R12, on the down converter input, for an indication of 2.3 volts rms on the HP 400D.

h. Set the output level of the Boonton 202J to 0 dbm. Adjust R9 on the sidewall of the receiver for a full scale reading on the signal level meter. Set the output level of the 202J to -100 dbm. Adjust R7 on the sidewall of the receiver for a -100 dbm indication on the signal level meter.

i. Alternately adjust R9 and R7 with the appropriate input signal level until the signal level meter reads approximately -100 dbm and 0 dbm for the corresponding input.

j. Set the attenuator on the 202J for minimum output. Connect a 240 ohm ±5% 1/2 watt resistor to the agc RECORD OUTPUT (J6) on the rear apron of the receiver. Connect an HP 412A, set to the -10 volt range, across the 240 ohm resistor.

k. Adjust the agc RECORD ADJ control (R10) on the rear apron of the receiver for a -5 volt indication on the HP 412A.

l. Set the output of the 202J to 0 dbm. Adjust the RECORD RANGE control (R13) on the agc subassembly for an indication of +5 volts on the HP 412A.

m. Set the output of the 202J to -100 dbm. Connect an HP 412A to TP1 on the demodulator. Set the agc NORMAL-OFF switch to OFF. Adjust R11 and observe that the indication on the HP 412A can be reduced to less than +4 volts.

n. Set the agc switch back to the NORMAL position.

o. Set the output level of the Boonton to 100 microvolts. Connect the HP 411A to J12, the IF OUTPUT jack, and observe the HP 411A for an indication of no less than 1 mv.

p. Set the output level of the Boonton to 1 millivolt (approximately). Connect the HP 412A to J16, the DEVIATION VOLTAGE OUTPUT. Set the HP 412A

to read +13 volts. Vary the deviation of the 202J from 0 to 125 kc at a 1.7 kc rate and observe the HP 412A varies from 0 to approximately 2.5 volts with 125 kc deviation.

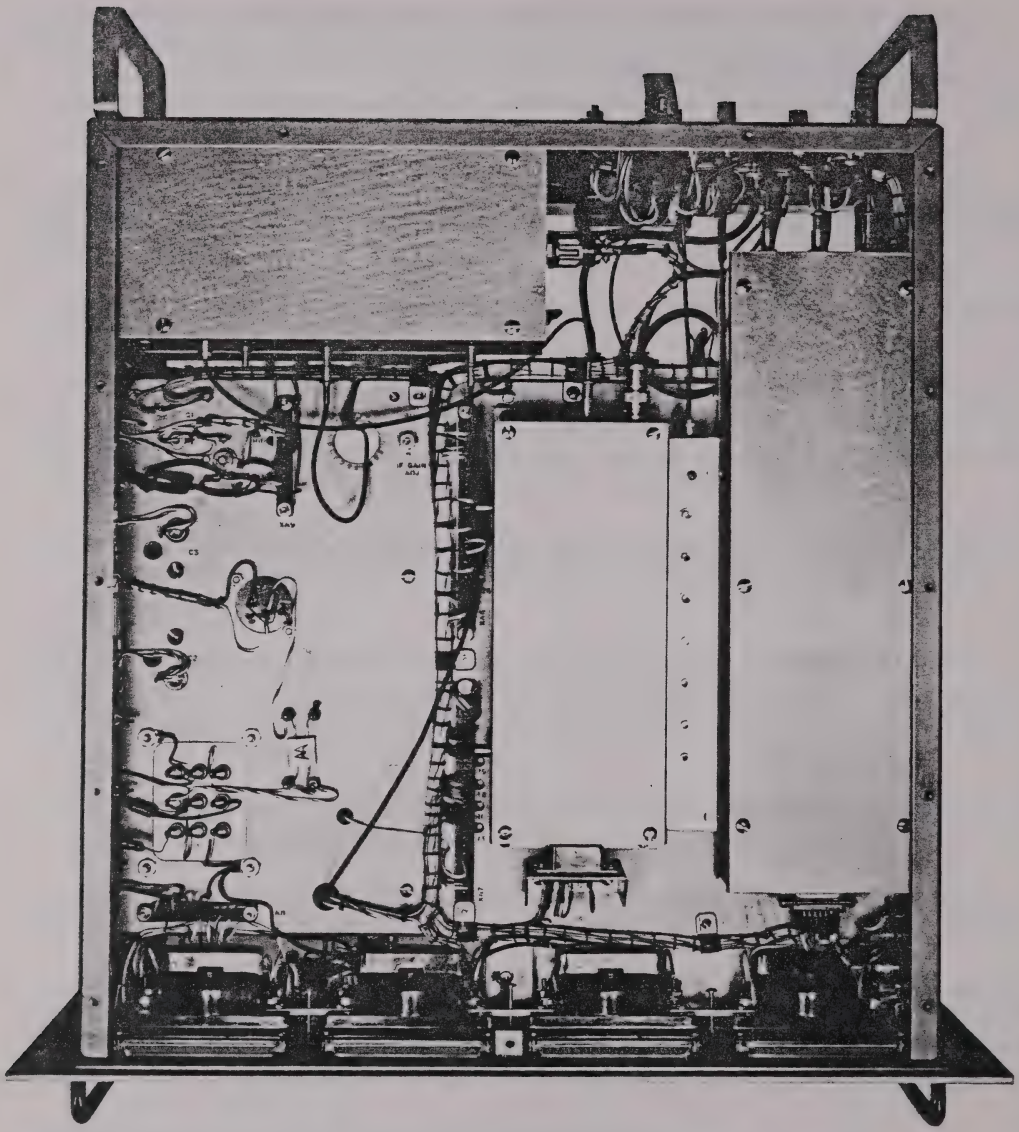


Figure 5-1. Model TMR-18B Telemetry Receiver, Top View with Cover Removed.

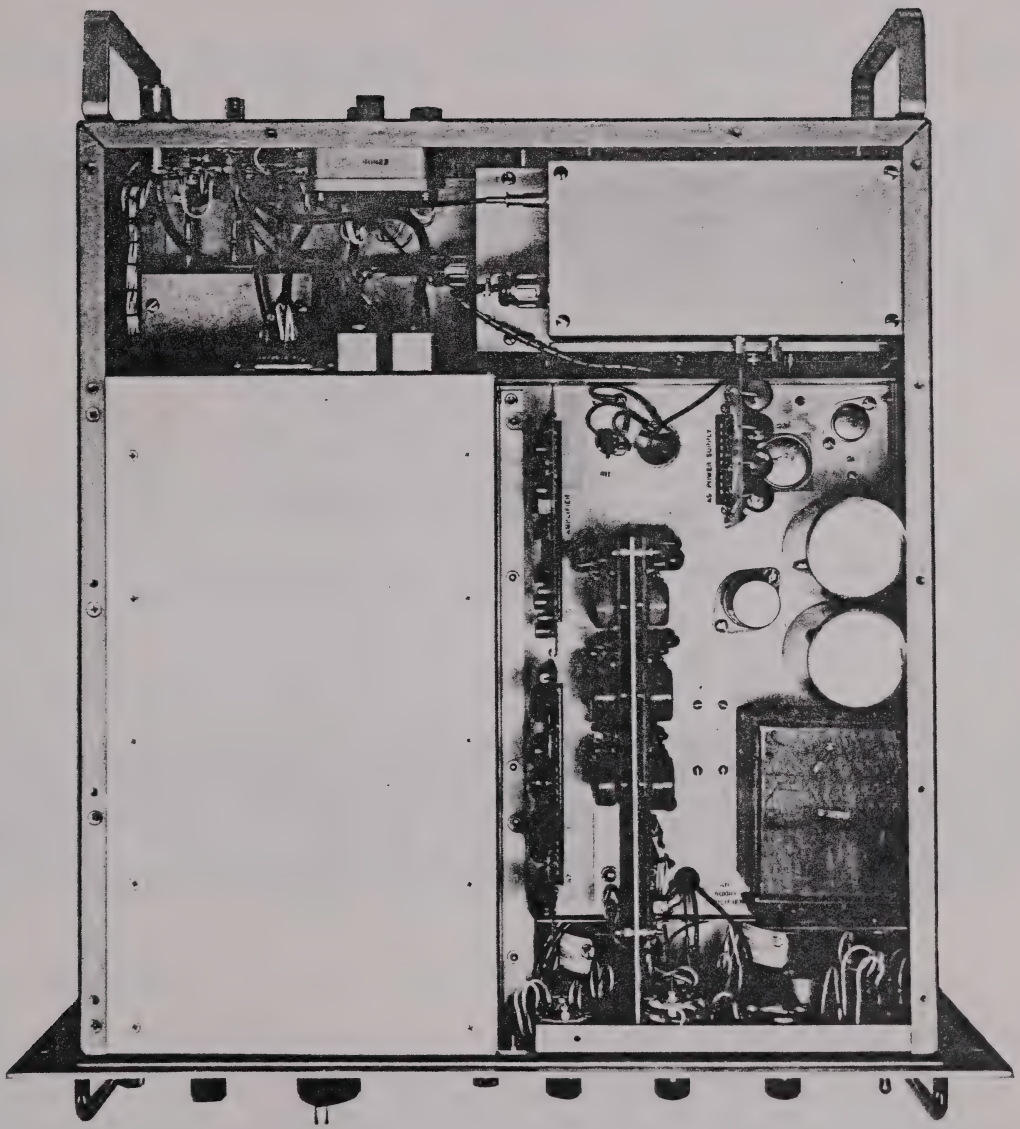


Figure 5-2. Model TMR-18B Telemetry Receiver, Bottom View with Cover Removed.

SECTION VI
INSTALLATION

6.1 RECEIPT AND UNPACKING

Upon receipt of the Model TMR-18B Telemetry Receiver, it should be unpacked and inspected for in-transit damage. When unpacking the unit, carefully open the outer packing material and lift out the inner package. Unwrap the inner package, ensuring that no hard or sharp tools touch the unit. Remove the unit from the inner package and place it in an upright position.

NOTE

The shipping containers are designed specifically to protect the unit from damage during normal handling. Any damage to the unit is an indication of improper handling. If there is any damage, notify the proper authority immediately.

The empty shipping material should be retained to be used in the event that the unit is to be stored or shipped at some later date.

6.2 INSPECTION

Inspect the main chassis for security of subassemblies and loose or disconnected wiring. Inspect the interior for damage to connectors and component parts. If the unit is not to be installed within a short period of time after it is received, it should be unpacked and inspected, then repacked and stored in an upright position. The environment of the storage area should be similar to that in which the unit will eventually be employed. (Refer to paragraph 6-4 for storage instructions.)

6.3 MOUNTING

The Model TMR-18B Telemetry Receiver is designed for either bench or standard rack mounting. The main chassis of the receiver is equipped with Jonathan 110QD-18-2 slide assembly to facilitate rack mounting. The receiver is 8-3/4 inches high, 19 inches wide, and 20-1/4 inches deep. With the tuning unit installed, the unit weighs approximately 40 pounds.

The input and output connectors are located on the rear apron of the receiver to facilitate its use in standard relay racks. See figure 6-1 for identification of the connectors. The cabling to and between the rear apron connectors depends on the task to be accomplished by the receiver. Table 6-1 may be used as a guide in making these connections.

After mounting (on bench or in rack) and installation of the appropriate rf tuning unit, the receiver requires only a source of power to be operational. The power requirements for the operating receiver are 115 vac 60 cycles, approximately 50 watts.

6.4 STORAGE

In the event the tuning unit is to be stored for a prolonged period of time, place the unit in its original shipping container, paragraph 6-1, or equivalent. Repack the original shipping container. Store the packed carton in a dry area similar to the environment in which the unit will eventually be employed, so that the unit does not encounter weather effects which may cause corrosion.

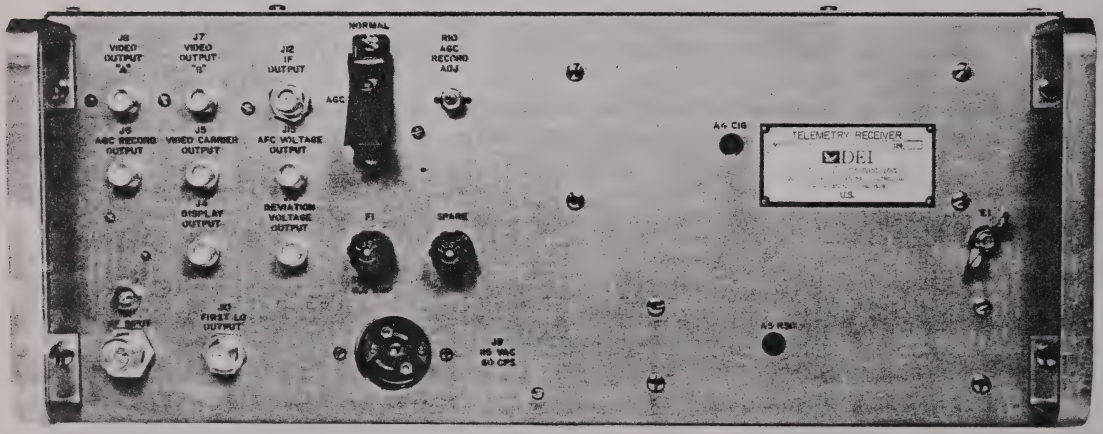


Figure 6-1. Model TMR-18B Telemetry Receiver, Rear View

6.5 SPECIAL MOUNTING REQUIREMENTS

There are no special mounting requirements to be followed when installing the receiver on a bench or in a rack. The information presented in paragraph 6-3 provides sufficient data to be used as criteria when installing the receiver in a site other than a standard rack or bench mount.

Table 6-1. Rear Apron Connectors

Connector	Nomenclature	Function
J1	RF INPUT	rf signal input connector.
J4	DISPLAY OUTPUT	30 mc i-f signal for application to a display unit.
J5	VIDEO CARRIER OUTPUT	predetection-recording video output for application to recording equipment. This output consists of either a 10 mc linear (before limiting) or a non-linear (after limiting) output controlled by an internal selection. Refer to paragraph 3-4.
J6	AGC RECORD OUTPUT	non-delayed agc voltage for recording purposes. This output is approximately equivalent to the agc signal which drives the signal level meter.
J7	VIDEO OUTPUT B	fm video output signal from video amplifier of channel B.
J8	VIDEO OUTPUT A	fm video output signal from video amplifier of channel A
J9	115 VAC 60 CY	power input connector.
J10	FIRST LO OUTPUT	first l-o output for monitoring purposes
J12	IF OUTPUT	10 mc second i-f output
J15	AFC VOLTAGE OUTPUT	voltage output for afc purposes.
J16	DEVIATION VOLTAGE OUTPUT	deviation voltage for external monitoring of the deviation present in the applied uf signal.

SECTION VII
ELECTRICAL PARTS LIST

MAIN CHASSIS

Reference Designation	Description
C1	Capacitor, dual electrolytic, 40 uf 250 vdc, Sprague TVL-2520
C2	Capacitor, electrolytic, 4000 uf 40 vdc, Sprague 36D1096T
C3	Capacitor, electrolytic, 4000 uf 40 vdc, Sprague 36D1096T
C4 through C7	Capacitor, integral part of Z1
C8	Capacitor, paper, 0.047 uf, ±20%, 200v, Aerovox P123ZNG7
C9	Capacitor, dur-mica, 20,000 uuf ±1%, Arco DM-30
C10	Capacitor, dur-mica, 23,807 uuf ±1%, Arco DM-30
C11	Capacitor, dur-mica, 27,188 uuf ±1%, Arco DM-30
C12	Capacitor, dur-mica, 5,380 uuf ±1%, Arco DM-20
C13	Capacitor, dur-mica, 21,904 uuf ±1%, Arco DM-30
C14	Capacitor, dur-mica, 13,594 uuf ±1%, Arco DM-30
C15	Capacitor, dur-mica, 2,653 uuf ±1%, Arco DM-19
C16	Capacitor, dur-mica, 10,952 uuf ±1%, Arco DM-30
C17	Capacitor, dur-mica, 6,800 uuf ±1%, Arco DM-20
C18	Capacitor, dur-mica, 1,291 uuf ±1%, Arco DM-19
C19	Capacitor, dur-mica, 5,476 uuf ±1%, Arco DM-20
C20	Capacitor, dur-mica, 3400 uuf ±1%, Arco DM-19
C21	Capacitor, dur-mica, 611 uuf ±1%, Arco DM-15
C22	Capacitor, dur-mica, 2,739 uuf ±1%, Arco DM-19
C23	Capacitor, dur-mica, 1,700 uuf ±1%, Arco DM-19
C24	Capacitor, dur-mica, 276 uuf ±1%, Arco DM-15
C25	Capacitor, dur-mica, 1,095 uuf ±1%, Arco DM-19
C26	Capacitor, dur-mica, 680 uuf ±1%, Arco DM-15
C27	Capacitor, dur-mica, 75 uuf ±1%, Arco DM-15
C28	Capacitor, dur-mica, 60 uf, ±10%, 6 vdc, Sprague 151D606X9006YZ

Main Chassis, cont'd

Reference Designation	Description
C29	Capacitor, dur-mica, 1.1 uf ±20%, 10 vdc, Sprague 151D115X0010W2
C30	Capacitor, dur-mica, 1 uf, 20 vdc, Sprague TL1170
CR1	Diode, zener, Hoffman 1N2005B
CR2	Diode, rectifier assembly, Motorola MDA-942-4
CR3	Diode, rectifier assembly, Motorola MDA-942-2
CR4	Diode, germanium, Sylvania 1N198
CR5	Diode, germanium, Sylvania 1N198
DS1	Indicator, lamp, General Electric 382
F1	Fuse, 0.8 amp, slo-blo, 3 ag Littelfuse
J1	Connector, integral part of W1
J2	Connector, integral part of W1
J3	Connector, 24 pin, receptacle, Amphenol 57-20240
J4	Connector, BNC, UG-1094/U
J5 through J8	Connector, BNC, UG-1094/U
J9	Connector, integral part of Z1
J10	Connector, integral part of W3
J11	Connector, integral part of W3
J12	Connector, integral part of W4
J13	Not assigned
J14	Not assigned
J15	Connector, BNC, UG-1094/U
J16	Connector, BNC, UG-1094/U

Main Chassis, cont'd

Reference Designation	Description
L1	Inductor, toroidal, DEI B20498
L2	Inductor, toroidal, DEI B20499
L3	Inductor, toroidal, DEI B20500
L4	Inductor, toroidal, DEI B20501
L5	Inductor, toroidal, DEI B20502
L6	Inductor, toroidal, DEI B20503
L7	Inductor, toroidal, DEI B20504
L8	Inductor, toroidal, DEI B20505
L9	Inductor, toroidal, DEI B20506
L10	Inductor, toroidal, DEI B20507
L11	Inductor, toroidal, DEI B20508
L12	Inductor, toroidal, DEI B20509
L13	Inductor, toroidal, DEI B20510
L14	Inductor, toroidal, DEI B20511
L15	Inductor, toroidal, DEI B20512
L16	Inductor, toroidal, DEI B20513
L17	Inductor, toroidal, DEI B20514
L18	Inductor, toroidal, DEI B20515
L19	Inductor, integral part of Z1
L20	Inductor, integral part of Z1
LS1	Speaker, 45Ω voice coil, Oakton S-8460
M1	Meter, output, DEI B19517
M2	Meter, deviation, DEI B33562
M3	Meter, tuning, DEI B19516
M4	Meter, signal level, DEI B34067

Main Chassis, cont'd

Reference Designation	Description
P1	Connector, integral part of W2
P2	Connector, integral part of W6
P3	Connector, Cannon DA-15S
P4	Connector, integral part of W4
P5	Not assigned
P6	Connector, 8 pin, Amphenol 26-4200-8S
P7	Not assigned
P8	Not assigned
P9	Connector, 9 pin, Amphenol 126-222
P10	Connector, integral part of W7
P11	Connector, 9 pin, Amphenol 126-222
P12	Connector, integral part of W5
Q1	Transistor, npn, RCA 40251
Q2	Transistor, pnp, Motorola 2N443
Q3	Transistor, Motorola 2N3251
Q4	Transistor, Motorola 2N708
R1	Resistor, wirewound, 910Ω ±3%, 10w, Dale RH-10
R2	Resistor, wirewound, 910Ω ±3%, 10w, Dale RH-10
R3	Resistor, wirewound, 1Ω, 3w, Sprague 242E1R05
R4	Resistor, wirewound, 1Ω, 3w, Sprague 242E1R05
R5	Potentiometer, 2.5k, 2w, DEI B31839
R6	Resistor, fixed composition, 7.5k ohm, ±5%, 1/2w, Allen Bradley EB7525
R7	Potentiometer, 5k, Allen Bradley RV6LAYSA502A
R8	Resistor, fixed composition, 750k ohm ±5%, 1/2w, Allen Bradley EB7545
R9	Potentiometer, 100k, Allen Bradley RV6LAYSA104A

Main Chassis, cont'd

Reference Designation	Description
R10	Potentiometer, 5k, Allen Bradley RV6LAYSA502A
R11	Potentiometer, 5k, Allen Bradley RV6LAYSA502A
R12	Resistor, fixed composition, 4.7k ohm ±5%, 1/2w, Allen Bradley EB4725
R13	Resistor, fixed composition, 360Ω ±5%, 1/2w, Allen Bradley EB3615
R14	Potentiometer, 2.5k, 1/2w, Allen Bradley 6A1G048P25-2UA
R15	Potentiometer, 1k, DEI B31838
R16	Not assigned
R17	Not assigned
R18	Resistor, fixed composition, 33Ω ±5%, 1/2w, Allen Bradley EB3305
R19	Resistor, fixed composition, 4.7k ±5%, 1/2w, Allen Bradley EB4725
R20	Resistor, fixed composition, 3.9k ohm ±5%, 1/4w, Allen Bradley CB3925
R21	Resistor, fixed composition, 3.9k ohm ±5%, 1/4w, Allen Bradley CB3925
R22	Resistor, fixed composition, 3.9k ohm ±5%, 1/4w, Allen Bradley CB3925
R23	Resistor, fixed composition, 4.3k ohm ±5%, 1/4w, Allen Bradley CB4325
R24	Resistor, fixed composition, 4.3k ohm ±5%, 1/4w, Allen Bradley CB4325
R25	Resistor, fixed composition, 4.3k ohm ±5%, 1/4w, Allen Bradley CB4325
R26	Resistor, fixed composition, 560Ω ±5%, 1/4w, Allen Bradley CB5615
R27	Resistor, fixed composition, 360Ω ±5%, 1/4w, Allen Bradley CB3615
R28	Potentiometer, modified DEI B34384
R29	Resistor, fixed composition, 1k ohm ±5%, 1/4w, Allen Bradley CB1025

Main Chassis, cont'd

Reference Designation	Description
R30	Resistor, fixed composition, 15k ohm ±5%, 1/4w, Allen Bradley CB1535
R31	Resistor, fixed composition, 1k ohm ±5%, 1/4w, Allen Bradley CB1025
R32	Resistor, fixed composition, 100Ω ±5%, 1/4w, Allen Bradley CB1015
R33	Resistor, fixed composition, 100k ohm ±5%, 1/4w, Allen Bradley CB1045
R34	Resistor, fixed composition, 150k ohm ±5%, 1/4w, Allen Bradley CB1545
R35	Resistor, fixed composition, 1k ohm ±5%, 1/4w, Allen Bradley CB1025
R36	Resistor, fixed composition, 56k ohm ±5%, 1/4w, Allen Bradley CB5635
R37	Potentiometer, wirewound, 100k ohm ±10%, 1/2w, Bourns 3068P-1-104
R38	Resistor, fixed composition, 16Ω ±5%, 1/2w, Allen Bradley EB1605
R39	Resistor, fixed composition, 16Ω ±5%, 1/2w, Allen Bradley EB1605
S1	Switch, dpst, toggle, H. H. Smith 522
S2	Switch, rotary, DEI B34385
S3	Switch, dpdt, H. H. Smith 523
S4	Switch, DEI B34386
T1	Transformer, power, DEI C19505
W1	Cable assembly, rf input, DEI B31835
W2	Cable assembly, display output, DEI B31834
W3	Cable assembly, 1st LO output, DEI B34465
W4	Cable assembly, IF output, DEI B34466

Main Chassis, cont'd

Reference Designation	Description
W5	Cable assembly, video carrier, DEI B31836
W6	Cable assembly, rf head, IF output, DEI B32107
W7	Cable assembly, demod to S4A, S4B, DEI B34467
Z1	Line filter box assembly, DEI B11822
XA1 through XA5	Not assigned
XA6	Receptacle, 25 pin with polarizing tab, Cinch 250-25-30-170
XA7 and XA8	Receptacle, 25 pin with polarizing tab, Cinch 250-25-30-170
XA9	Receptacle, 10 pin with polarizing tab, Cinch 250-25-30-170
XDS1	Pilot light assembly, Dialco 111-4630-111
XF1	Fuseholder, Littelfuse 342004

A2, FIRST IF AMPLIFIER

Reference Designation	Description
C1 through C9	Capacitor, ceramic, disc, 1000 uuf ±10%, Erie HR-809-X5T
C10	Capacitor, ceramic, tubular, 22 uuf ±5%, Erie NPO 301-000
C11	Capacitor, ceramic, disc, 1000 uuf ±10%, Erie HR-809-X5T
C12	Capacitor, ceramic, disc, 1000 uuf ±10%, Erie HR-809-X5T
C13	Capacitor, ceramic, tubular, 27 uuf ±5%, Erie NPO 308-000
C14	Capacitor, ceramic, disc, 1000 uuf ±10%, Erie HR-809-X5T
C15	Capacitor, ceramic, disc, 1000 uuf ±10%, Erie HR-809-X5T
C16	Capacitor, ceramic, tubular, 20 uuf ±5%, Erie NPO 301-000
C17	Capacitor, ceramic, disc, 1000 uuf ±10%, Erie HR-809-X5T
C18	Capacitor, ceramic, disc, 1000 uuf ±10%, Erie HR-809-X5T
C19	Capacitor, tubular, 0.22 uf ±20%, 200 vdc, Aerovox P123ZNGP
C20	Not assigned
C21	Capacitor, ceramic, disc, 5000 uuf +60%-40%, Centralab DDM-502
C22	Capacitor, ceramic, tubular, 47 uuf ±5%, Erie NPO 308-000
C23	Capacitor, ceramic, disc, 1000 uuf ±10%, Erie HR-809-X5T
C24	Capacitor, ceramic, disc, 1000 uuf ±10%, Erie HR-809-X5T
C25	Capacitor, silver mica, 220 uuf ±5%, Elmenco CM15F221J
C26	Capacitor, silver mica, 56 uuf ±5%, Elmenco DM15-560J
C27	Capacitor, ceramic, tubular, 1.0 uuf ±0.1 uuf, Erie NPO 301-000
C28	Capacitor, ceramic, disc, 0.01 uf +100%-20%, Erie 805-Z5V
C29	Capacitor, ceramic, disc, 5000 uuf +60%-40%, Centralab DDM-502
C30	Capacitor, ceramic, tubular, 24 uuf ±5%, Erie NPO 301-000
C31	Capacitor, ceramic, disc, 1000 uuf ±10%, Erie HR-809-X5T
C32	Capacitor, ceramic, tubular, 39 uuf ±5%, Erie N330-309-000
C33	Capacitor, silver mica, 300 uuf ±5%, Elmenco CM15F301J
C34	Capacitor, ceramic, disc, 1000 uuf ±10%, Erie HR-809-X5T
C35	Capacitor, ceramic, disc, 0.01 uf +100%-20%, Erie 805-Z5V

A2, First IF Amplifier, cont'd

Reference Designation	Description
C36	Capacitor, ceramic, disc, 0.01 uf +100%-20%, Erie 805-Z5V
C37	Capacitor, ceramic, disc, 1000 uuf ±10%, Erie HR-809-X5T
C38	Capacitor, silver mica, 470 uuf ±5%, Elmenco CM15F471J
C39	Capacitor, ceramic, disc, 1000 uuf ±10%, Erie HR-809-X5T
C40	Capacitor, silver mica, 82 uuf ±5%, Elmenco CM15E820J
C41	Capacitor, ceramic, tubular, 27 uuf ±5%, Erie NPO 308-000
C42	Capacitor, ceramic, tubular, 24 uuf ±5%, Erie N330-301-000
C43	Not assigned
C44	Capacitor, silver mica, 82 uuf ±5%, Elmenco CM15E820J
C45	Not assigned
C46	Capacitor, glass variable, 0.8-4.5 uuf, JFD VC10GWY
C47	Capacitor, ceramic, tubular, 0.001 uf ±10%, Elmenco CM-15-102-K
C48	Not assigned
C49	Capacitor, 0.5 uf, 50 wvdc, Hopkins P5P5D
C50	Capacitor, ceramic, tubular, 24 uuf ±5%, Erie NPO 301-000
C51	Capacitor, ceramic, tubular, 47 uuf ±5%, Erie NPO 308-000
C52	Capacitor, ceramic, tubular, 24 uuf ±5%, Erie NPO 301-000
C53	Capacitor, ceramic, disc, 1000 uuf ±10%, Erie HR-809-X5T
C54	Not assigned
C55	Capacitor, ceramic, disc, 5000 uuf +60%-40%, Centralab DDM-502
C56	Capacitor, ceramic, disc, 5000 uuf +60%-40%, Centralab DDM-502
C57	Capacitor, ceramic, disc, 5000 uuf +60%-40%, Centralab DDM-502
C58	Capacitor, ceramic, disc, 5000 uuf +60%-40%, Centralab DDM-502
C59	Capacitor, ceramic, disc, 5000 uuf +60%-40%, Centralab DDM-502
C60	Capacitor, ceramic, disc, 0.01 uf +100%-20%, Erie 805-Z5V
C61	Capacitor, ceramic, disc, 0.01 uf +100%-20%, Erie 805-Z5V
C62	Capacitor, ceramic, disc, 1000 uuf ±10%, Erie HR-809-X5T
C63	Capacitor, ceramic, disc, 5000 uuf +60%-40%, Centralab DDM-502

A2, First IF Amplifier, cont'd

Reference Designation	Description
CR1	Diode, silicon, Fairchild 1N3600
CR2	Diode, silicon, Fairchild 1N3600
CR3 through CR6	Diode, silicon, Hewlett Packard Associates 1001
CR7	Diode, varicap, PSI PC1147
CR8	Diode, zener, Motorola 1N752
CR9	Diode, silicon, Fairchild 1N3600
CR10	Diode, silicon, Fairchild 1N3600
CR11 through CR14	Diode, germanium, 1N198
CR15	Diode, silicon, 1N483
J1	Connector, Microdot 032-0120
J2	Connector, Microdot 032-0120
J3	Connector, Microdot 032-0120
J4	Connector, Cannon DA-15P
L1 through L4	Inductor, fixed rf, 47 uh ±10%, Essex WEE-47
L5	Inductor assembly, DEI C18045
L6	Inductor, fixed rf, 47 uh ±10%, Essex WEE-47
L7	Inductor assembly, DEI C18045
L8	Inductor, glass, 0.20 uh, JFD LF4W020
L9	Inductor, 27 uh ±10%, Essex WEE-27
L10	Inductor, fixed rf, 47 uh ±10%, Essex WEE-47
L11	Inductor, fixed rf, 47 uh ±10%, Essex WEE-47
L12	Inductor, 1.8 uh ±10%, Essex WEE-1.8
L13	Inductor, 1.8 uh ±10%, Essex WEE-1.8

A2, First IF Amplifier, cont'd

Reference Designation	Description
L14	Inductor, 100 uh, Essex WEE-100
Q1 through Q5	Transistor, silicon, npn, RCA 2N3478
Q6	Transistor, silicon, npn, Motorola 2N3291
Q7	Transistor, silicon, npn, Motorola 2N3291
Q8	Transistor, silicon, npn, RCA 2N3478
Q9	Transistor, silicon, npn, Motorola 2N3291
Q10	Transistor, silicon, npn, RCA 2N3478
Q11	Transistor, silicon, npn, RCA 2N3478
Q12	Transistor, silicon, npn, RCA 2N3478
R1	Resistor, fixed composition, 39Ω ±5%, 1/2w, Allen Bradley EB3905
R2	Resistor, fixed composition, 39Ω ±5%, 1/2w, Allen Bradley EB3905
R3	Resistor, fixed composition, 12Ω ±5%, 1/2w, Allen Bradley EB1205
R4	Resistor, fixed composition, 470Ω ±5%, 1/4w, Allen Bradley CB4715
R5	Resistor, fixed composition, 470Ω ±5%, 1/4w, Allen Bradley CB4715
R6	Resistor, fixed composition, 82k ohm ±5%, 1/2w, Allen Bradley EB8235
R7	Resistor, fixed composition, 4.7k ohm ±5%, 1/2w, Allen Bradley EB4725
R8	Not assigned
R9	Resistor, fixed composition, 470Ω ±5%, 1/2w, Allen Bradley EB4715
R10	Resistor, fixed composition, 2.7k ohm ±5%, 1/2w, Allen Bradley EB2725

A2, First IF Amplifier, cont'd

Reference Designation	Description
R11	Resistor, fixed composition, 33Ω ±5%, 1/2w, Allen Bradley EB3305
R12	Resistor, fixed composition, 43Ω ±5%, 1/2w, Allen Bradley EB4305
R13	Resistor, fixed composition, 3.3k ohm ±5%, 1/2w, Allen Bradley EB3325
R14	Resistor, fixed composition, 200Ω ±5%, 1/2w, Allen Bradley EB2015
R15	Resistor, fixed composition, 750Ω ±5%, 1/4w, Nominal value
R16	Resistor, fixed composition, 470Ω ±5%, 1/2w, Allen Bradley EB4715
R17	Resistor, fixed composition, 47Ω ±5%, 1/2w, Allen Bradley EB4705
R18	Resistor, fixed composition, 3.3k ohm ±5%, 1/2w, Allen Bradley EB3325
R19	Resistor, fixed composition, 200Ω ±5%, 1/2w, Allen Bradley EB2015
R20	Resistor, fixed composition, 270Ω ±5%, 1/4w, Nominal value
R21	Resistor, fixed composition, 47Ω ±5%, 1/2w, Allen Bradley EB4705
R22	Resistor, fixed composition, 3.3k ohm ±5%, 1/2w, Allen Bradley EB3325
R23	Resistor, fixed composition, 470Ω ±5%, 1/2w, Allen Bradley EB4715
R24	Resistor, fixed composition, 470Ω ±5%, 1/4w, Nominal value
R25	Resistor, fixed composition, 390Ω ±5%, 1/2w, Allen Bradley EB3915
R26	Resistor, fixed composition, 3.9k ohm ±5%, 1/2w, Allen Bradley EB3925
R27 through R30	Resistor, fixed carbon film, 200Ω ±1%, 1/4w, Electra RN60D

A2, First IF Amplifier, cont'd

Reference Designation	Description
R31	Resistor, fixed composition, 47Ω ±5%, 1/4w, Allen Bradley CB4705
R32	Resistor, fixed composition, 100Ω ±5%, 1/2w, Allen Bradley EB1015
R33	Resistor, fixed composition, 470Ω ±5%, 1/2w, Allen Bradley EB4715
R34	Resistor, fixed composition, 4.7k ohm ±5%, 1/2w, Allen Bradley EB4725
R35	Resistor, fixed composition, 10k ohm ±5%, 1/2w, Allen Bradley EB1035
R36	Resistor, fixed composition, 1.0k ohm ±5%, 1/2w, Allen Bradley EB1025
R37	Resistor, fixed composition, 3.3k ohm ±5%, 1/2w, Allen Bradley EB3325
R38	Resistor, fixed composition, 10k ohm ±5%, 1/2w, Allen Bradley EB1035
R39	Resistor, fixed composition, 4.7k ohm ±5%, 1/2w, Allen Bradley EB4725
R40	Resistor, fixed composition, 2.0k ohm ±5%, 1/2w, Allen Bradley EB2025
R41	Resistor, fixed composition, 1.0k ohm ±5%, 1/2w, Allen Bradley EB1025
R42	Resistor, fixed composition, 3.3k ohm ±5%, 1/2w, Allen Bradley EB3325
R43	Resistor, fixed composition, 56Ω ±5%, 1/2w, Allen Bradley EB5605
R44	Resistor, fixed composition, 240Ω ±5%, 1/2w, Allen Bradley EB2415
R45	Resistor, fixed composition, 100k ohm ±5%, 1/2w, Allen Bradley EB1045
R46	Resistor, fixed composition, 7.5k ohm ±5%, 1/2w, Allen Bradley EB7525
R47	Not assigned

A2, First IF Amplifier, cont'd

Reference Designation	Description
R48	Resistor, fixed composition, 200Ω ±5%, 1/2w, Allen Bradley EB2015
R49	Not assigned
R50	Resistor, fixed composition, 390Ω ±5%, 1/2w, Allen Bradley EB3915
R51	Resistor, fixed composition, 470Ω ±5%, 1/2w, Allen Bradley EB4715
R52	Resistor, fixed composition, 390Ω ±5%, 1/2w, Allen Bradley EB3915
R53	Resistor, fixed composition, 82k ohm ±5%, 1/2w, Allen Bradley EB8235
R54	Resistor, fixed composition, 4.7k ohm ±5%, 1/2w, Allen Bradley EB4725
R55	Resistor, fixed composition, 330Ω ±5%, 1/2w, Allen Bradley EB3315
R56	Resistor, fixed composition, 2.7k ohm ±5%, 1/2w, Allen Bradley EB2725
R57	Resistor, fixed composition, 470Ω ±5%, 1/2w, Allen Bradley EB4715
R58	Resistor, fixed composition, 39Ω ±5%, 1/4w, Allen Bradley CB3905
R59	Resistor, fixed composition, 4.7k ohm ±5%, 1/2w, Allen Bradley EB4725
R60	Resistor, fixed composition, 1.0k ohm ±5%, 1/2w, Allen Bradley EB1025
R61	Resistor, fixed composition, 1.0k ohm ±5%, 1/2w, Allen Bradley EB1025
R62	Not assigned
R63	Resistor, fixed composition, 470Ω ±5%, 1/2w, Allen Bradley EB4715
R64	Resistor, fixed composition, 200Ω ±5%, 1/2w, Allen Bradley EB2015
R65	Not assigned

A2, First IF Amplifier, cont'd

Reference Designation	Description
R66	Resistor, fixed composition, 4.7k ohm, ±5%, 1/2w, Allen Bradley EB4725
R67	Resistor, fixed composition, 10k ohm ±5%, 1/2w, Allen Bradley EB1035
R68	Resistor, fixed composition, 56Ω ±5%, 1/4w, Allen Bradley CB5605
T1	Transformer assembly, DEI C18039
T2	Transformer assembly, DEI C18040
T3	Transformer assembly, DEI C18040
T4	Transformer assembly, DEI C18041
T5	Transformer assembly, DEI C18042
T6	Transformer assembly, DEI C18042
T7	Transformer assembly, DEI C18044
T8	Transformer assembly, DEI C18043
Y1	Crystal, 40.000 mc, CR-55/U

A3, SECOND IF AMPLIFIER

Reference Designation	Description
C1	Capacitor, variable,glass, 0.7-12 uuf, JFD VC22GYCE
C2	Capacitor, mica, dipped, 100 uuf ±1%, Arco DM10F101F
C3	Capacitor, ceramic,tubular, 4.7 uuf ±0.25 uuf, Erie NPO 301-000
C4	Capacitor, ceramic,tubular, 8.2 uuf ±0.25 uuf, Erie NPO 301-000
C5	Capacitor, variable,glass, 0.7-12 uuf, JFD VC22GYCE
C6	Capacitor, mica, dipped, 110 uuf ±1%, Arco DM10F111F
C7	Capacitor, ceramic,tubular, 4.7 uuf ±0.25 uuf, Erie NPO 301-000
C8	Capacitor, ceramic,tubular, 5.1 uuf ±0.25 uuf, Erie NPO 301-000
C9	Capacitor, variable,glass, 0.7-12 uuf, JFD VC22GYCE
C10	Capacitor, mica, dipped, 100 uuf ±1%, Arco DM10F101F
C11	Capacitor, ceramic,tubular, 4.7 uuf ±0.25 uuf, Erie NPO 301-000
C12	Capacitor, ceramic,tubular, 3.6 uuf ±0.1 uuf, Erie NPO 301-000
C13	Capacitor, variable,glass, 0.7-12 uuf, JFD VC22GYCE
C14	Capacitor, mica, dipped, 110 uuf ±1%, Arco DM10F111F
C15	Capacitor, ceramic,tubular, 3.3 uuf ±0.25 uuf, Erie NPO 301-000
C16	Capacitor, variable,glass, 0.7-12 uuf, JFD VC22GYCE
C17	Capacitor, mica, 100 uuf ±1%, Arco DM10F101F
C18	Capacitor, ceramic,tubular, 4.7 uuf ±0.25 uuf, Erie NPO 301-000
C19	Capacitor, ceramic,tubular, 5.1 uuf ±0.25 uuf, Erie NPO 301-000
C20	Capacitor, variable,glass, 0.7-12 uuf, JFD VC22GYCE
C21	Capacitor, mica, dipped, 110 uuf ±1%, Arco DM10F111F
C22	Capacitor, ceramic,tubular, 4.7 uuf ±0.25 uuf, Erie NPO 301-000
C23	Capacitor, ceramic,tubular, 8.2 uuf ±0.25 uuf, Erie NPO 301-000
C24	Capacitor, mica, dipped, 100 uuf ±1%, Arco DM10F101F
C25	Capacitor, ceramic,tubular, 4.7 uuf ±0.25 uuf, Erie NPO 301-000
C26	Capacitor, variable,glass, 0.7-12 uuf, JFD VC22GYCE
C27	Capacitor, ceramic, disc, 5000 uuf +60%-40%, Centralab DDM-502
C28	Capacitor, ceramic, disc, 1500 uuf +100%-20%, Erie CK61Y152Z

A3, Second IF Amplifier, cont'd

Reference Designation	Description
C29	Capacitor, ceramic, tubular, 30 uuf ±5%, Erie NPO 308-000
C30	Capacitor, ceramic, disc, 5000 uuf +60%-40%, Centralab DDM-502
C31	Capacitor, ceramic, disc, 1500 uuf +100%-20%, Erie CK61Y152Z
C32	Capacitor, ceramic, tubular, 30 uuf ±5%, Erie NPO 308-000
C33	Capacitor, ceramic, disc, 5000 uuf +60%-40%, Centralab DDM-502
C34	Capacitor, ceramic, tubular, 30 uuf ±5%, Erie NPO 308-000
C35	Capacitor, ceramic, disc, 1500 uuf +100%-20%, Erie CK61Y152Z
C36	Capacitor, ceramic, disc, 5000 uuf +60%-40%, Centralab DDM-502
C37	Capacitor, ceramic, disc, 5000 uuf +60%-40%, Centralab DDM-502
C38	Capacitor, ceramic, disc, 5000 uuf +60%-40%, Centralab DDM-502
C39	Capacitor, ceramic, disc, 5000 uuf +6-%-40%, Centralab DDM-502
C40	Capacitor, ceramic, disc, 1500 uuf +100%-20%, Erie CK61Y152Z
C41	Capacitor, ceramic, tubular, 30 uuf ±5%, Erie NPO 308-000
C42	Capacitor, ceramic, disc, 5000 uuf +60%-40%, Centralab DDM-502
C43	Capacitor, ceramic, tubular, 0.1 uf ±10%, 20 vdc, Sprague 150D104X9020J
C44	Capacitor, ceramic, disc, 1500 uuf +100%-20%, Erie CK61Y152Z
C45	Capacitor, ceramic, tubular, 10 uuf ±5%, Erie NPO 301-000
C46	Capacitor, ceramic, disc, 5000 uuf +60%-40%, Centralab DDM-502
C47	Capacitor, ceramic, disc, 5000 uuf +60%-40%, Centralab DDM-502
C48 through C51	Capacitor, ceramic, disc, 5000 uuf +60%-40%, Centralab DDM-502
C52	Capacitor, ceramic, tubular, 0.1 uf ±10%, 29 vdc, Sprague 150D104X9020J
CR1	Diode, Fairchild 1N3600
E1	Termination, integral part of W1

A3, Second IF Amplifier, cont'd

Reference Designation	Description
J1	Connector, Microdot 032-0120
J2	Connector, Amphenol 26-4100-8P
J3	Connector, UG-1094/U
L1	Inductor, DEI B17685-1
L2	Inductor, DEI B17685-2
L3	Inductor, DEI B17685-3
L4	Inductor, DEI B17685-3
L5	Inductor, DEI B17685-3
L6	Inductor, DEI B17685-2
L7	Inductor, DEI B17685-4
L8	Inductor, fixed, 220 uh ±5%, Essex WEE 220
L9	Inductor, fixed, 220 uh ±5%, Essex WEE 220
P1	Connector, integral part of W1
Q1	Transistor, RCA 2N3478
Q2	Transistor, RCA 2N3478
Q3	Transistor, Fairchild 2N3563
Q4	Transistor, Fairchild 2N3563
Q5	Transistor, Fairchild 2N3563
Q6	Transistor, RCA 2N708
R1	Resistor, fixed composition, 56Ω ±5%, 1/2w, Allen Bradley EB5605
R2	Resistor, fixed composition, 4.7Ω ±5%, 1/4w, Allen Bradley CB4G75
R3	Resistor, fixed composition, 15Ω ±5%, 1/2w, Allen Bradley EB1505

A3, Second IF Amplifier, cont'd

Reference Designation	Description
R4	Resistor, fixed composition, 13k ohm ±5%, 1/2w, Allen Bradley EB1335
R5	Resistor, fixed composition, 390Ω ±5%, 1/2w, Allen Bradley EB3915
R6	Resistor, fixed composition, 470Ω ±5%, 1/2w, Allen Bradley EB4715
R7	Resistor, fixed composition, 270Ω ±5%, 1/4w, Nominal value
R8	Resistor, fixed composition, 27Ω ±5%, 1/2w, Allen Bradley EB2705
R9	Resistor, fixed composition, 3.9k ohm ±5%, 1/2w, Allen Bradley EB3925
R10	Resistor, fixed composition, 390Ω ±5%, 1/2w, Allen Bradley EB3915
R11	Resistor, fixed composition, 300Ω ±5%, 1/2w, Nominal value
R12	Resistor, fixed composition, 470Ω ±5%, 1/2w, Allen Bradley EB4715
R13	Resistor, fixed composition, 3.3k ohm ±5%, 1/4w, Nominal value
R14	Resistor, fixed composition, 27Ω ±5%, 1/2w, Allen Bradley EB2705
R15	Resistor, fixed composition, 3.9k ohm ±5%, 1/2w, Allen Bradley EB3925
R16	Resistor, fixed composition, 390Ω ±5%, 1/2w, Allen Bradley EB3915
R17	Resistor, fixed composition, 470Ω ±5%, 1/2w, Allen Bradley EB4715
R18	Resistor, fixed composition, 470Ω ±5%, 1/2w, Allen Bradley EB4715
R19	Resistor, fixed composition, 470Ω ±5%, 1/2w, Allen Bradley EB4715
R20	Resistor, fixed composition, 7.5k ohm ±5%, 1/2w, Allen Bradley EB7525

A3, Second IF Amplifier, cont'd

Reference Designation	Description
R21	Resistor, fixed composition, 27Ω ±5%, 1/2w, Allen Bradley EB2705
R22	Resistor, fixed composition, 3.9k ohm ±5%, 1/2w, Allen Bradley EB3925
R23	Resistor, fixed composition, 390Ω ±5%, 1/2w, Allen Bradley EB3915
R24	Resistor, fixed composition, 470Ω ±5%, 1/2w, Allen Bradley EB4715
R25	Resistor, fixed composition, 300Ω ±5%, 1/4w, Nominal value
R26	Resistor, fixed composition, 27Ω ±5%, 1/2w, Allen Bradley EB2705
R27	Resistor, fixed composition, 2.4k ohm ±5%, 1/2w, Allen Bradley EB2425
R28	Resistor, fixed composition, 820Ω ±5%, 1/4w, Nominal value
R29	Resistor, fixed composition, 1.8k ohm ±5%, 1/2w, Allen Bradley EB1825
R30	Resistor, fixed composition, 390Ω ±5%, 1/2w, Allen Bradley EB3915
R31	Resistor, fixed composition, 100Ω ±5%, 1/2w, Allen Bradley EB1015
R32	Resistor, fixed composition, 3.3k ohm ±5%, 1/2w, Allen Bradley EB3325
R33	Resistor, fixed composition, 620Ω ±5%, 1/2w, Allen Bradley EB6215
R34	Resistor, fixed composition, 180Ω ±5%, 1/2w, Allen Bradley EB1815
R35	Resistor, fixed composition, 180Ω ±5%, 1/2w, Allen Bradley EB1815
R36	Resistor, fixed composition, 220Ω ±5%, 1/2w, Allen Bradley EB2215
R37	Resistor, fixed composition, 51Ω ±5%, 1/2w, Allen Bradley EB5105

A3, Second IF Amplifier, cont'd

Reference Designation	Description
R38	Resistor, fixed composition, 1.3k ohm, ±5%, 1/2w Allen Bradley EB1325
T1	Transformer, DEI C17823
T2	Transformer, DEI C17824
T3	Transformer, DEI C17992
T4	Transformer, DEI C17824
T5	Transformer, DEI C17825
T6	Transformer, DEI C17826
W1	Cable assembly, DEI B31837

A4, FM DEMODULATOR

Reference Designation	Description
C1	Capacitor, ceramic, disc, 0.005 uf, 150 vdc, Centralab DDM-502
C2	Capacitor, ceramic, disc, 0.005 uf, 150 vdc, Centralab DDM-502
C3	Capacitor, ceramic, tubular, 24 uuf ±5%, Erie NPO-A 301-000
C4	Capacitor, ceramic, disc, 0.005 uf, 150 vdc, Centralab DDM-502
C5	Capacitor, ceramic, disc, 0.005 uf, 150 vdc, Centralab DDM-502
C6	Capacitor, ceramic, disc, 0.005 uf, 150 vdc, Centralab DDM-502
C7 through C9	Capacitor, ceramic, disc, 0.005 uf, 150 vdc, Centralab DDM-502
C10	Capacitor, ceramic, tubular, 27 uuf ±5%, Erie NPO-T 308-000
C11	Capacitor, ceramic, disc, 0.005 uf, 150 vdc, Centralab DDM-502
C12	Capacitor, ceramic, tubular, 22 uuf ±5%, Erie NPO-A 301-000
C13	Capacitor, ceramic, disc, 0.005 uf, 150 vdc, Centralab DDM-502
C14	Capacitor, ceramic, disc, 0.005 uf, 150 vdc, Centralab DDM-502
C15	Capacitor, ceramic, disc, 0.005 uf, 150 vdc, Centralab DDM-502
C16	Capacitor, variable, glass, 0.8-8.5 uuf, JFD VC9GWY
C17	Capacitor, ceramic, tubular, 47 uuf ±5%, Erie NPO-T 308-000
C18	Not assigned
C19	Capacitor, ceramic, disc, 0.005 uf, 150 vdc, Centralab DDM-502
C20	Not assigned
C21	Not assigned
C22	Capacitor, ceramic, disc, 0.005 uf, 150 vdc, Centralab DDM-502
C23	Capacitor, silvered mica, 100 uuf ±5%, Arco CM15F101J
C24	Not assigned
C25	Not assigned
C26	Not assigned
C27	Capacitor, silvered mica, 100 uuf ±5%, Arco CM15F101J
C28	Capacitor, ceramic, disc, 0.01 uf -20% +80%, 100 vdc, Erie 805-Z5V

A4, FM Demodulator, cont'd

Reference Designation	Description
C29	Capacitor, ceramic, disc, 0.001 uf ±10%, Erie HR-809-X5T
CR1	Diode, silicon, Continental Device 1N914
CR2	Diode, silicon, Continental Device 1N914
CR3	Not assigned
CR4	Not assigned
CR5	Diode, germanium, Sylvania 1N283
E1	Integral part of W1
J1	Connector, 9 pin, Amphenol 126-219
J2	Integral part of W1
J3	Integral part of W2
J4	Integral part of W3
J5	Connector, coaxial, Microdot O32-0120
L1	Inductor, variable, DEI C19197
L2	Inductor, fixed, 15 uh ±10%, Wilco 1015-15
L3	Inductor, fixed, 15 uh ±10%, Wilco 1015-15
L4	Inductor, fixed, 220 uh ±5%, Essex WEE-220
L5	Inductor, fixed, 220 uh ±5%, Essex WEE-220
L6	Not assigned
L7	Inductor, fixed, 220 uh ±5%, Essex WEE-220
L8	Inductor, fixed, 220 uh ±5%, Essex WEE-220
Q1 through Q5	Transistor, npn, silicon, Fairchild 2N3564
Q6	Transistor, npn, silicon, RCA 2N708

A4, FM Demodulator, cont'd

Reference Designation	Description
Q7	Transistor, npn, silicon, RCA 2N708
Q8	Transistor, npn, silicon, Motorola 2N2218
Q9	Transistor, pnp, silicon, Motorola 2N3133
R1	Resistor, fixed composition, 47Ω ±5%, 1/2w, Allen Bradley EB4705
R2	Resistor, fixed composition, 51Ω ±5%, 1/2w, Allen Bradley EB5105
R3	Resistor, fixed composition, 100Ω ±5%, 1/2w, Allen Bradley EB1015
R4	Resistor, fixed composition, 1.3k ohm ±5%, 1/2w, Allen Bradley EB1325
R5	Resistor, fixed composition, 100Ω ±5%, 1/2w, Allen Bradley EB1015
R6	Resistor, fixed composition, 100Ω ±5%, 1/2w, Allen Bradley EB1015
R7	Resistor, fixed composition, 2k ohm ±5%, 1/2w, Allen Bradley EB2025
R8	Resistor, fixed composition, 10Ω ±5%, 1/2w, Allen Bradley EB1005
R9	Resistor, fixed composition, 10Ω ±5%, 1/2w, Allen Bradley EB1005
R10	Resistor, fixed composition, 2k ohm ±5%, 1/2w, Allen Bradley EB2025
R11	Resistor, fixed composition, 2k ohm ±5%, 1/2w, Allen Bradley EB2025
R12	Resistor, fixed composition, 51Ω ±5%, 1/2w, Allen Bradley EB5105
R13	Resistor, fixed composition, 100Ω ±5%, 1/2w, Allen Bradley EB1015
R14	Resistor, fixed composition, 2k ohm ±5%, 1/2w, Allen Bradley EB2025
R15	Resistor, fixed composition, 2k ohm ±5%, 1/2w, Allen Bradley EB2025

A4, FM Demodulator, cont'd

Reference Designation	Description
R16	Resistor, fixed composition, 2k ohm ±5%, 1/2w, Allen Bradley EB2025
R17	Resistor, fixed composition, 51Ω ±5%, 1/2w, Allen Bradley EB5105
R18	Resistor, fixed composition, 100Ω ±5%, 1/2w, Allen Bradley EB1015
R19	Resistor, fixed composition, 220Ω ±5%, 1/2w, Allen Bradley EB2215
R20	Resistor, fixed composition, 100Ω ±5%, 1/2w, Allen Bradley EB1015
R21	Resistor, fixed composition, 100Ω ±5%, 1/2w, Allen Bradley EB1015
R22	Resistor, fixed composition, 620Ω ±5%, 1/2w, Allen Bradley EB6215
R23	Resistor, fixed composition, 200Ω ±5%, 1/2w, Allen Bradley EB2015
R24	Resistor, fixed composition, 51Ω ±5%, 1/2w, Allen Bradley EB5105
R25	Resistor, fixed composition, 51Ω ±5%, 1/2w, Allen Bradley EB5105
R26	Resistor, fixed composition, 10k ohm ±5%, 1/2w, Allen Bradley EB1035
R27	Resistor, fixed composition, 10k ohm ±5%, 1/2w, Allen Bradley EB1035
R28	Not assigned
R29	Not assigned
R30	Resistor, fixed composition, 47k ohm ±5%, 1/2w, Allen Bradley EB4735
R31	Resistor, fixed composition, 3k ohm ±5%, 1/2w, Allen Bradley EB3025
R32	Resistor, fixed composition, 3k ohm ±5%, 1/2w, Allen Bradley EB3025
R33	Resistor, fixed composition, 47k ohm ±5%, 1/2w, Allen Bradley EB4735

A4, FM Demodulator, cont'd

Reference Designation	Description
R34	Resistor, fixed composition, 100Ω ±5%, 1/2w, Allen Bradley EB1015
R35	Resistor, fixed composition, 20Ω ±5%, 1/2w, Allen Bradley EB2005
R36	Resistor, fixed composition, 20Ω ±5%, 1/2w, Allen Bradley EB2005
R37	Resistor, fixed composition, 100Ω ±5%, 1/2w, Allen Bradley EB1015
R38 through R48	Not assigned
R49	Resistor, fixed composition, 10k ohm ±5%, 1/2w, Allen Bradley EB1035
R50 through R52	Not assigned
R53	Resistor, fixed composition, 8.2k ohm ±5%, 1/4w, Allen Bradley CB8225
R54	Not assigned
R55	Not assigned
R56	Resistor, fixed composition, 51Ω ±5%, 1/2w, Allen Bradley EB5105
R57	Resistor, fixed composition, 47Ω ±5%, 1/2w, Allen Bradley EB4705
R58	Resistor, fixed composition, 47Ω ±5%, 1/2w, Allen Bradley EB4705
R59	Not assigned
R60	Resistor, fixed composition, 47Ω ±5%, 1/2w, Allen Bradley EB4705
R61	Not assigned
R62	Not assigned
R63	Resistor, fixed composition, 3k ohm ±5%, 1/2w, Allen Bradley EB3025

A4, FM Demodulator, cont'd

Reference Designation	Description
R64	Resistor, fixed composition, 51k ohm ±5%, 1/2w, Allen Bradley EB5135
R65	Resistor, fixed composition, 10k ohm ±5%, 1/2w, Allen Bradley EB1035
R66	Not assigned
R67	Not assigned
R68	Not assigned
R69	Resistor, fixed composition, 47k ohm ±5%, 1/2w, Allen Bradley EB4735
R70	Resistor, fixed composition, 10k ohm ±5%, 1/2w, Allen Bradley EB1035
T1	Transformer assembly, DEI C19199
T2	Transformer assembly, DEI C19198
TP1	Terminal, test point, USECO 1430
W1	Coaxial, cable assembly, DEI B31840
W2	Coaxial, cable assembly, DEI B32003
W3	Coaxial, cable assembly, DEI B32003

A5, PREDETECTION DOWN CONVERTER

Reference Designation	Description
C1	Capacitor, ceramic tubular, 0.51 uuf ±0.1 uuf, Erie NPO-A 301-000
C2	Capacitor, ceramic tubular, 22 uuf ±5%, Erie NPO-A 301-000
C3	Capacitor, mica, dipped, 240 uuf ±5%, Arco DM15F241J
C4	Capacitor, ceramic, disc, 0.001 uf ±10%, Erie HR-809-X5T
C5	Capacitor, ceramic tubular, 10 uuf ±5%, Erie 301-000
C6	Capacitor, ceramic, disc, 0.01 uf +80% -20%, Erie 805-Z5V
C7	Capacitor, ceramic, disc, 0.01 uf +80% -20%, Erie 805-Z5V
C8	Capacitor, ceramic, disc, 0.001 uf ±10%, Erie HR-809-X5T
C9	Capacitor, ceramic, disc, 0.01 uf +80% -20%, Erie 805-Z5V
C10	Capacitor, ceramic, disc, 0.01 uf +80% -20%, Erie 805-Z5V
C11	Capacitor, mica, dipped, 120 uuf ±5%, Arco DM15F121J
C12	Capacitor, mica, dipped, 120 uuf ±5%, Arco DM15F121J
C13	Capacitor, mica, dipped, 390 uuf ±5%, Arco DM15F391J
C14	Capacitor, electrolytic, 1 uf -10% +100%, 20 vdc, Sprague TL-1170
C15	Capacitor, paper, 1 uf ±20%, 50 vdc, Hopkins 1PP5D
C16	Capacitor, electrolytic, 1 uf -10% +100%, 20 vdc, Sprague TL-1170
C17	Not assigned
C18	Capacitor, metalized paper, 0.047 uf ±20%, 200v, Aerovox P123ZNGP
C19	Capacitor, mica, dipped, 110 uuf ±5%, Arco DM15F111J
C20	Capacitor, mica, dipped, 110 uuf ±5%, Arco DM15F111J
C21	Capacitor, electrolytic, 20 uf -10% +100%, 20 vdc, Sprague TL-1179
C22	Capacitor, electrolytic, 1 uf -10% +100%, 20 vdc, Sprague TL-1170
C23	Capacitor, electrolytic, 10 uf -10% +100%, 20 vdc, Sprague TL-1177
C24	Capacitor, metalized paper, 0.47 uf ±20%, 200v, Aerovox P123ZNGP
L1	Inductor, fixed rf, 150 uh ±5%, Essex WEE-150
L2	Inductor, fixed rf, 68 uh ±5%, Essex WEE-68

A5, Predetection Down Converter, cont'd

Reference Designation	Description
L3	Inductor, fixed rf, 220 uh ±5%, Essex WEE-220
L4	Inductor, fixed rf, 220 uh ±5%, Essex WEE-220
Q1 through Q5	Transistor, silicon, RCA 2N708
Q6	Transistor, silicon, Fairchild 2N3566
Q7	Transistor, silicon, Motorola 2N3251
Q8	Transistor, silicon, Motorola 2N697
Q9	Transistor, silicon, Motorola 2N2218
Q10	Transistor, silicon, Motorola 2N3133
R1	Resistor, fixed composition, 27k ohm ±5%, 1/2w, Allen Bradley EB2735
R2	Resistor, fixed composition, 6.2k ohm ±5%, 1/2w, Allen Bradley EB6225
R3	Resistor, fixed composition, 18k ohm ±5%, 1/2w, Allen Bradley EB1835
R4	Resistor, fixed composition, 22k ohm ±5%, 1/2w, Allen Bradley EB2235
R5	Resistor, fixed composition, 1k ohm ±5%, 1/2w, Allen Bradley EB1025
R6	Resistor, fixed composition, 390Ω ±5%, 1/2w, Allen Bradley EB3915
R7	Resistor, fixed composition, 390Ω ±5%, 1/2w, Allen Bradley EB3915
R8	Resistor, fixed composition, 470Ω ±5%, 1/2w, Allen Bradley EB4715
R9	Resistor, fixed composition, 270Ω ±5%, 1/2w, Allen Bradley EB2715
R10	Resistor, fixed composition, 1.8k ohm ±5%, 1/2w, Allen Bradley EB1825

A5, Predetection Down Converter, cont'd

Reference Designation	Description
R11	Resistor, fixed composition, 100Ω ±5%, 1/2w, Allen Bradley EB1015
R12	Potentiometer, composition, 100Ω ±20%, 1/2w, Allen Bradley RV6LA4SA101A
R13	Resistor, fixed composition, 100Ω ±5%, 1/2w, Allen Bradley EB1015
R14	Resistor, fixed composition, 3k ohm ±5%, 1/2w, Allen Bradley EB3025
R15	Resistor, fixed composition, 470Ω ±5%, 1/2w, Allen Bradley EB4715
R16	Resistor, fixed composition, 470Ω ±5%, 1/2w, Allen Bradley EB4715
R17	Resistor, fixed composition, 5.6k ohm ±5%, 1/2w, Allen Bradley EB5625
R18	Resistor, fixed composition, 12k ohm ±5%, 1/2w, Allen Bradley EB1235
R19	Resistor, fixed composition, 5.1k ohm ±5%, 1/2w, Allen Bradley EB5125
R20	Resistor, fixed composition, 22k ohm ±5%, 1/2w, Allen Bradley EB2235
R21	Resistor, fixed composition, 300Ω ±5%, 1/2w, Allen Bradley EB3015
R22	Resistor, fixed composition, 100Ω ±5%, 1/2w, Allen Bradley EB1015
R23	Resistor, fixed composition, 330Ω ±5%, 1/2w, Allen Bradley EB3315
R24	Resistor, fixed composition, 1.8k ohm ±5%, 1/2w, Allen Bradley EB1825
R25	Resistor, fixed composition, 1k ohm ±5%, 1/2w, Allen Bradley EB1025
R26	Resistor, fixed composition, 330Ω ±5%, 1/2w, Allen Bradley EB3315
R27	Resistor, fixed composition, 560Ω ±5%, 1/2w, Allen Bradley EB5615

A5, Predetection Down Converter, cont'd

Reference Designation	Description
R28	Resistor, fixed composition, 33k ohm ±5%, 1/2w, Allen Bradley EB3335
R29	Resistor, fixed composition, 100Ω ±5%, 1/2w, Allen Bradley EB1015
R30	Potentiometer, wire wound, 2k ohm ±10%, 1/2w, Bourns 3067P-1-202
R31	Resistor, fixed composition, 3.6k ohm ±5%, 1/2w, Allen Bradley EB3635
R32	Resistor, fixed composition, 1.5k ohm ±5%, 1/2w, Allen Bradley EB1525
R33	Resistor, fixed composition, 5.1k ohm ±5%, 1/2w, Allen Bradley EB5125
R34	Resistor, fixed composition, 130Ω ±5%, 1/2w, Allen Bradley EB1315
R35	Resistor, fixed composition, 1k ohm ±5%, 1w, Allen Bradley GB1025
R36	Resistor, fixed composition, 100Ω ±5%, 1/2w, Allen Bradley EB1015
R37	Resistor, fixed composition, 33Ω ±5%, 1/2w, Allen Bradley EB3305
R38	Resistor, fixed composition, 10Ω ±5%, 1/2w, Allen Bradley EB1005
R39	Resistor, fixed composition, 22Ω ±5%, 1/2w, Allen Bradley EB2205
R40	Resistor, fixed composition, 22Ω ±5%, 1/2w, Allen Bradley EB2205
R41	Resistor, fixed composition, 75Ω ±5%, 1/2w, Allen Bradley EB7505
T1	Transformer assembly, DEI C31792

A6, AGC AMPLIFIER

Reference Designation	Description
C1	Capacitor, metalized paper, 0.068 uf ±20%, 200v, Aerovox P123ZNGP
C2	Capacitor, electrolytic, 10 uf -10% +100%, 20v, Sprague TL-1177
C3	Capacitor, electrolytic, 10 uf -10% +100%, 20v, Sprague TL-1177
CR1	Diode, Sylvania 1N483
CR2	Diode, Sylvania 1N198
CR3	Diode, zener, 6.8v, Motorola 1/4M6.8Z
Q1	Transistor, Motorola 2N3251
Q2	Transistor, Fairchild 2N3566
Q3	Transistor, Motorola 2N3251
Q4	Transistor, Motorola 2N706A
Q5	Transistor, Motorola 2N706A
Q6	Transistor, Motorola 2N2218
Q7	Transistor, Motorola 2N3133
R1	Resistor, fixed composition, 470Ω ±5%, 1/2w, Allen Bradley EB4715
R2	Potentiometer, wirewound, 2k ohm ±10%, 1/2w, Bourns 3067P-1-202
R3	Resistor, fixed composition, 1k ohm ±5%, 1/2w, Allen Bradley EB1025
R4	Resistor, fixed composition, 1k ohm ±5%, 1/2w, Allen Bradley EB1025
R5	Resistor, fixed composition, 1 meg ±5%, 1/2w, Allen Bradley EB1055
R6	Resistor, fixed composition, 12k ohm ±5%, 1/2w, Allen Bradley EB1235
R7	Resistor, fixed composition, 10k ohm ±5%, 1/2w, Allen Bradley EB1035

A6, AGC Amplifier, cont'd

Reference Designation	Description
R8	Resistor, fixed composition, 1.2k ohm ±5%, 1/2w, Allen Bradley EB1225
R9	Resistor, fixed composition, 1.5k ohm ±5%, 1/2w, Allen Bradley EB1525
R10	Potentiometer, wirewound, 10k ohm ±10%, 1/2w, Bourns 3067P-1-103
R11	Resistor, fixed composition, 3k ohm ±5%, 1/2w, Allen Bradley EB3025
R12	Resistor, fixed composition, 22k ohm ±5%, 1/2w, Allen Bradley EB2235
R13	Potentiometer, wirewound, 5k ohm ±10%, 1/2w, Bourns 3067P-1-502
R14	Resistor, fixed composition, 8.2k ohm ±5%, 1/2w, Allen Bradley EB8225
R15	Resistor, fixed composition, 220k ohm ±5%, 1/2w, Allen Bradley EB2245
R16	Resistor, fixed composition, 6.8k ohm ±5%, 1/2w, Allen Bradley EB6825
R17	Resistor, fixed composition, 1.8k ohm ±5%, 1/2w, Allen Bradley EB1825
R18	Resistor, fixed composition, 15k ohm ±5%, 1/2w, Allen Bradley EB1535
R19	Resistor, fixed composition, 200k ohm ±5%, 1/2w, Allen Bradley EB2045
R20	Resistor, fixed composition, 100Ω ±5%, 1/2w, Allen Bradley EB1015
R21	Resistor, fixed composition, 150k ohm ±5%, 1/2w, Allen Bradley EB1545
R22	Resistor, fixed composition, 100Ω ±5%, 1/2w, Allen Bradley EB1015
R23	Resistor, fixed composition, 100Ω ±5%, 1/2w, Allen Bradley EB1015
R24	Resistor, fixed composition, 5.6k ohm ±5%, 1/2w, Allen Bradley EB5625

A6, AGC Amplifier, cont'd

Reference Designation	Description
R25	Resistor, fixed composition, 5.1k ohm ±5%, 1/2w, Allen Bradley EB5125
R26	Potentiometer, wirewound, 1k ohm ±10%, 1/2w, Bourns 3067P-1-102
R27	Resistor, fixed composition, 2k ohm ±5%, 1/2w, Allen Bradley EB2025
R28	Resistor, fixed composition, 330Ω ±5%, 1/2w, Allen Bradley EB3315
R29	Resistor, fixed composition, 3.3k ohm ±5%, 1/2w, Allen Bradley EB3325
R30	Resistor, fixed composition, 220Ω ±5%, 1/2w, Allen Bradley EB2215
R31	Resistor, fixed composition, 10Ω ±5%, 1/2w, Allen Bradley EB1005
R32	Resistor, fixed composition, 22Ω ±5%, 1/2w, Allen Bradley EB2205
R33	Resistor, fixed composition, 220Ω ±5%, 1/2w, Allen Bradley EB2215
R34	Resistor, fixed composition, 100k ohm ±5%, 1/2w, Allen Bradley EB1045

A7, DUAL VIDEO AMPLIFIER

Reference Designation	Description
C1	Capacitor, mica, dipped, 100 uuf ±5%, 500 vdc, Arco DM10-101J
C2	Capacitor, mica, dipped, 100 uuf ±5%, 500 vdc, Arco DM10-101J
C3	Capacitor, ceramic tubular, 0.22 uf ±10%, 200 vdc, Sprague 192P22492
C4	Capacitor, electrolytic, 100 uf, 20 vdc, IEI APD-095-0
C5	Capacitor, ceramic tubular, 0.22 uf ±10%, 200 vdc, Sprague 192P22492
C6	Capacitor, electrolytic, 100 uf, 20 vdc, IEI APD-095-0
L1	Inductor, fixed, 220 uh, Essex WEE-220
L2	Inductor, fixed, 220 uh, Essex WEE-220
Q1	Transistor, Fairchild 2N3566
Q2	Transistor, Motorola 2N3251
Q3	Transistor, Motorola 2N697
Q4	Transistor, Motorola 2N2218
Q5	Transistor, Motorola 2N3133
Q6	Transistor, Fairchild 2N3566
Q7	Transistor, Motorola 2N3251
Q8	Transistor, Motorola 2N697
Q9	Transistor, Motorola 2N2218
Q10	Transistor, Motorola 2N3133
R1	Resistor, potentiometer, 2k, E-Z Trim, Bourns 3067P-1-202
R2	Resistor, potentiometer, 2k, E-Z Trim, Bourns 3067P-1-202
R3	Resistor, potentiometer, 2k, E-Z Trim, Bourns 3067P-1-202
R4	Resistor, fixed composition, 3.6k ohm ±5%, 1/2w, Allen Bradley EB3625
R5	Resistor, fixed composition, 100Ω ±5%, 1/2w, Allen Bradley EB1015

A8, AUDIO AMPLIFIER

Reference Designation	Description
C1	Capacitor, ceramic, 3300 uuf ±20%, 200 vdc, Sprague 192033202
C2	Capacitor, ceramic, tubular, 15 uuf ±5%, Erie NPO 301-000
C3	Capacitor, electrolytic, 2 uf -10% +100%, 20 vdc, Sprague TL1171
C4	Capacitor, electrolytic, 10 uf -10% +100%, 20 vdc, Sprague TL1177
C5	Capacitor, ceramic, 0.01 uf ±20%, 200 vdc, Sprague 192D10302
CR1 through CR5	Diode, Sylvania 1N283
Q1	Transistor, RCA 2N1308
Q2	Transistor, RCA 2N1308
Q3	Transistor, RCA 2N1309
R1	Resistor, fixed composition, 5.1k ohm ±5%, 1/2w, Allen Bradley EB5125
R2	Resistor, fixed composition, 5.1k ohm ±5%, 1/2w, Allen Bradley EB5125
R3	Resistor, fixed composition, 91Ω ±5%, 1/2w, Allen Bradley EB9105
R4	Resistor, fixed composition, 4.3k ohm ±5%, 1/2w, Allen Bradley EB4325
R5	Resistor, fixed composition, 3.9k ohm ±5%, 1/2w, Allen Bradley EB3925
R6	Resistor, fixed composition, 56Ω ±5%, 1/2w, Allen Bradley EB5605
R7	Resistor, fixed composition, 10Ω ±5%, 1/2w, Allen Bradley EB1005
R8	Resistor, fixed composition, 8.2k ohm ±5%, 1/2w, Allen Bradley EB8225
R9	Resistor, fixed composition, 10Ω ±5%, 1/2w, Allen Bradley EB1005

A7, Dual Video Amplifier, cont'd

Reference Designation	Description
R23	Resistor, fixed composition, 22Ω ±5%, 1/2w, Allen Bradley EB2205
R24	Resistor, fixed composition, 33Ω ±5%, 1/2w, Allen Bradley EB3305
R25	Resistor, fixed composition, 10Ω ±5%, 1/2w, Allen Bradley EB1005
R26	Resistor, fixed composition, 20Ω ±5%, 1/2w, Allen Bradley EB2005
R27	Resistor, fixed composition, 22Ω ±5%, 1/2w, Allen Bradley EB2205
R28	Resistor, fixed composition, 22Ω ±5%, 1/2w, Allen Bradley EB2205
R29	Resistor, fixed composition, 130Ω ±5%, 1/2w, Allen Bradley EB1315
R30	Resistor, fixed composition, 20Ω ±5%, 1/2w, Allen Bradley EB2005

A8, AUDIO AMPLIFIER

Reference Designation	Description
C1	Capacitor, ceramic, 3300 uuf ±20%, 200 vdc, Sprague 192033202
C2	Capacitor, ceramic, tubular, 15 uuf ±5%, Erie NPO 301-000
C3	Capacitor, electrolytic, 2 uf -10% +100%, 20 vdc, Sprague TL1171
C4	Capacitor, electrolytic, 10 uf -10% +100%, 20 vdc, Sprague TL1177
C5	Capacitor, ceramic, 0.01 uf ±20%, 200 vdc, Sprague 192D10302
CR1 through CR5	Diode, Sylvania 1N283
Q1	Transistor, RCA 2N1308
Q2	Transistor, RCA 2N1308
Q3	Transistor, RCA 2N1309
R1	Resistor, fixed composition, 5.1k ohm ±5%, 1/2w, Allen Bradley EB5125
R2	Resistor, fixed composition, 5.1k ohm ±5%, 1/2w, Allen Bradley EB5125
R3	Resistor, fixed composition, 91Ω ±5%, 1/2w, Allen Bradley EB9105
R4	Resistor, fixed composition, 4.3k ohm ±5%, 1/2w, Allen Bradley EB4325
R5	Resistor, fixed composition, 3.9k ohm ±5%, 1/2w, Allen Bradley EB3925
R6	Resistor, fixed composition, 56Ω ±5%, 1/2w, Allen Bradley EB5605
R7	Resistor, fixed composition, 10Ω ±5%, 1/2w, Allen Bradley EB1005
R8	Resistor, fixed composition, 8.2k ohm ±5%, 1/2w, Allen Bradley EB8225
R9	Resistor, fixed composition, 10Ω ±5%, 1/2w, Allen Bradley EB1005

A7, Dual Video Amplifier, cont'd

Reference Designation	Description
R23	Resistor, fixed composition, 22Ω ±5%, 1/2w, Allen Bradley EB2205
R24	Resistor, fixed composition, 33Ω ±5%, 1/2w, Allen Bradley EB3305
R25	Resistor, fixed composition, 10Ω ±5%, 1/2w, Allen Bradley EB1005
R26	Resistor, fixed composition, 20Ω ±5%, 1/2w, Allen Bradley EB2005
R27	Resistor, fixed composition, 22Ω ±5%, 1/2w, Allen Bradley EB2205
R28	Resistor, fixed composition, 22Ω ±5%, 1/2w, Allen Bradley EB2205
R29	Resistor, fixed composition, 130Ω ±5%, 1/2w, Allen Bradley EB1315
R30	Resistor, fixed composition, 20Ω ±5%, 1/2w, Allen Bradley EB2005

A9, POWER SUPPLY REGULATOR

Reference Designation	Description
C1	Capacitor, electrolytic, 400 uf, 25 vdc, IEI APD-136
C2	Capacitor, electrolytic, 400 uf, 25 vdc, IEI APD-136
C3	Capacitor, ceramic, disc, 0.01 uf, -20% +100%, 100 vdc, Erie 805-Z5V
C4	Capacitor, ceramic, disc, 0.01 uf, -20% +100%, 100 vdc, Erie 805-Z5V
C5	Capacitor, electrolytic, 400 uf, 25 vdc, IEI APD-136
C6	Capacitor, electrolytic, 400 uf, 25 vdc, IEI APD-136
CR1	Diode, zener, Motorola 1N3681B
CR2	Diode, zener, Motorola 1N3681B
Q1	Transistor, npn, RCA 2N1701
Q2	Transistor, pnp, RCA 2N1183B
Q3	Transistor, npn, Motorola 2N706A
Q4	Transistor, pnp, Motorola 2N1192
R1	Resistor, fixed composition, 510Ω ±5%, 1/2w, Allen Bradley EB5115
R2	Resistor, fixed composition, 510Ω ±5%, 1/2w, Allen Bradley EB5115
R3	Resistor, fixed composition, 680Ω ±5%, 1/2w, Allen Bradley EB6815
R4	Resistor, fixed composition, 680Ω ±5%, 1/2w, Allen Bradley EB6815
R5	Resistor, fixed composition, 47Ω ±5%, 1/4w, Allen Bradley CB4705
R6	Resistor, fixed composition, 47Ω ±5%, 1/4w, Allen Bradley CB4705
R7	Resistor, fixed composition, 330Ω ±5%, 1/2w, Allen Bradley EB3315

A8, Audio Amplifier, cont'd

Reference Designation	Description
R10	Resistor, fixed composition, 620Ω ±5%, 1/2w, Allen Bradley EB6215
R11	Resistor, fixed composition, 1k ohm ±5%, 1/2w, Allen Bradley EB1025
R12	Resistor, fixed composition, 510Ω ±5%, 1/2w, Allen Bradley EB5115
R13	Resistor, fixed composition, 91Ω ±5%, 1/2w, Allen Bradley EB9105

A9, Power Supply Regulator, cont'd

Reference Designation	Description
R8	Resistor, fixed composition, 330Ω ±5%, 1/2w, Allen Bradley EB3315
R9	Resistor, fixed composition, 68Ω ±5%, 1/2w, Allen Bradley EB6805
R10	Potentiometer, wirewound, 200Ω ±10%, 1/2w, Bourns 3067P-1-201
R11	Resistor, fixed composition 910Ω ±5%, 1/2w, Allen Bradley EB9115
R12	Resistor, fixed composition, 750Ω ±5%, 1/2w, Allen Bradley EB7515
R13	Potentiometer, wirewound, 200Ω ±10%, 1/2w, Bourns 3067P-1-201
R14	Resistor, fixed composition, 100Ω ±5%, 1/2w, Allen Bradley EB1015

SECTION VIII
SCHEMATIC DIAGRAMS

This section contains the schematic diagrams for the TMR-18B receiver main chassis and the subassembly modules, excluding the rf tuning unit. Unless otherwise noted, the following information applies to each schematic diagram:

a. Capacitor values less than one are in microfarads.

b. Capacitor values greater than one are in picofarads (micromicrofarads).

c. Inductance values are in microhenrys.

d. Resistor values are in ohms, K=1000, M=1, 000, 000.

e. ⊘ Internal adjustment.

f. Arrow denotes clockwise rotation.

g. ○ Operating control.

h. * Typical value.